AvanWaves User Guide

Release 1997.4

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Introduction

This user guide describes the AvanWaves tool for displaying, analyzing, and printing the results of HSPICE simulations. It describes the features of AvanWaves and shows how to use them to perform various types of analysis on HSPICE results. The Getting Started chapter is intended as an introduction to using AvanWaves. More complex examples are provided in Chapter 11, “Running the Tutorial.” The remaining chapters explore the operations of the tool in more detail.

Detailed information on the other topics, such as HSPICE, are found in their respective manuals.

Who Should Use This Guide?

This guide is intended for anyone involved in analyzing the results of HSPICE simulations using AvanWaves.

Organization

Chapter 1 provides an introduction to AvanWaves features, a description of the design flow, input and output files, and directory structures.

Chapter 2 provides a simple example of using AvanWaves to analyze a DC simulation in HSPICE.

Chapter 3 describes how AvanWaves uses design files from HSPICE simulations.

Chapter 4 describes the main functions and features of the AvanWaves user interface.

Chapter 5 describes the operations that can be performed on waveforms.

Chapter 6 describes how operators, functions, macros, and expressions can be used to analyze simulation results.

Chapter 7 describes what configurations are and how to use them.

Chapter 8 describes how to set preferences and customize the AvanWaves operation.

Chapter 9 describes how the AvanWaves Run Manager can be used to control HSPICE simulations.

Chapter 10 describes how to use the Microsoft Windows Launcher to control HSPICE simulations.

Chapter 11 is a tutorial containing examples of using AvanWaves to analyze AC and transient HSPICE simulation.

Chapter 12 describes the on-line Help system provided with AvanWaves.

Appendix A provides a summary of the commands available in AvanWaves.

Appendix B provides a list of the available mathematical functions and operators.

Appendix C provides the glossary of terms and a description of naming conventions.

Documentation Conventions

Typographical Conventions

The following table describes the typographical conventions used in this manual.

Convention	Meaning
Note:	Contains information of special importance
Italics	Identifies file, directory, and path names appearing in text. References to file names with the general form *<name>.ext* may be abbreviated as *.ext* files.
`Courier`	Identifies typed user input, file examples, or screen output.

Convention	Meaning
Ctrl-x	Indicates that you hold down the **Ctrl** key while you are pressing the **x** key.

Command Syntax and File Formats

Command line syntax and file formats are defined using BNF-based rules, as summarized in the table below.

Convention	Meaning
<abcd>	‘abcd’ describes the type of information required
[efgh]	‘efgh’ is an optional parameter
(x | y | z)	one of x, y, or z is required
(x | y | z)...	selection of x, y, or z can be repeated (Selections are additive.)
[x | y | z]	one of x, y, or z may be selected
‘(’ l m n ‘)’	syntax characters within single quotes, such as parentheses, are required

Related Documents

Refer to the following document for additional information on this release of the AvanWaves product:

- AvanWaves Release Notes, Release 1997.3

Refer to the following document for further information on the HSPICE product:

- *HSPICE User’s Manual*, Version 96.1 for HSPICE Release 96.1

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1

Introducing AvanWaves

This chapter introduces you to the AvanWaves product, and describes the features available and the input files utilized.

AvanWaves version 1997.4 is available on UNIX and PC platforms only.

Features

AvanWaves provides a convenient graphical interface to display, analyze, and print the results of Star-Hspice simulations. This version of AvanWaves enables you to

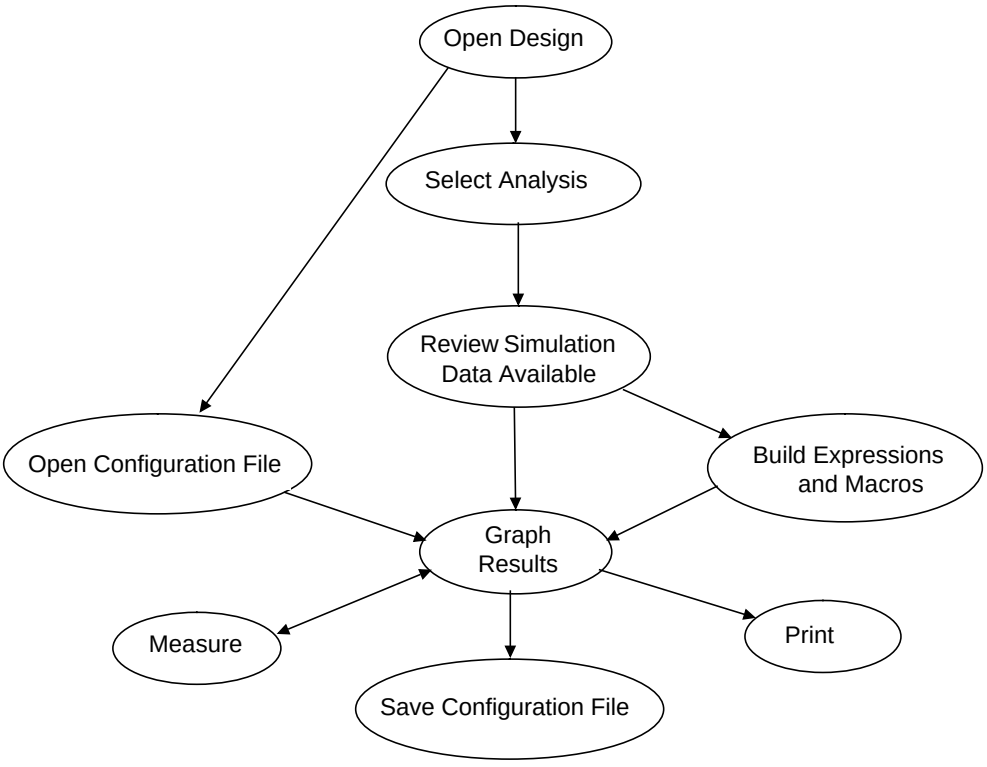
- Load all files associated with a particular design in one step
- Open multiple designs simultaneously
- Update an existing design with information obtained from a new simulation run
- Superimpose results with two different data types within one graph, using up to two different Y-axes
- Build algebraic expressions and macros to modify and combine simulation results for display
- Graph (without limitations) simulation results or for displaying panels
- Interactively measure and label data on waveforms

- Save and restore all aspects of a particular design analysis as a configuration
- Look at individual parametric variations using the Sweep Filter
- Produce hard copy prints of the design analysis and results display
- Access online Help
- Run Star-Hspice within the waveform analysis section

Design Flow

The design flow diagram for AvanWaves is shown in Figure 1-1.

Figure 1-1 AvanWaves Design Flow Diagram



Input Files

Star-Hspice run files and configuration files saved during a AvanWaves session are used as input to AvanWaves. The configuration file is located in a directory having the same name as your current design with a *.sav* extension. The configuration file is located in the *<design_name>.sav* directory and has a *.cfg* extension.

The Star-Hspice run files used as input to AvanWaves are listed in Table 1-1.

Table 1-1 Files used as input to AvanWaves

Design File Name	Description
<design>.sp	Star-Hspice input netlist
<design>.st#	Status file
<design>.pa#	Subcircuit cross-listing file
<design>.lis	Output listing file
<design>.tr#	*T*ransient analysis results
<design>.mt#	*T*ransient measure data file. An associated *<design>.tr#* file must exist for this file to be current
<design>.ac#	AC analysis results
<design>.ma#	AC analysis measurement results
<design>.sw#	DC analysis results
<design>.ms#	DC analysis measurement results
<design>.xp#	Transient analysis results
<design>.cm#	Transient analysis results
<design>.wv#	Transient analysis results

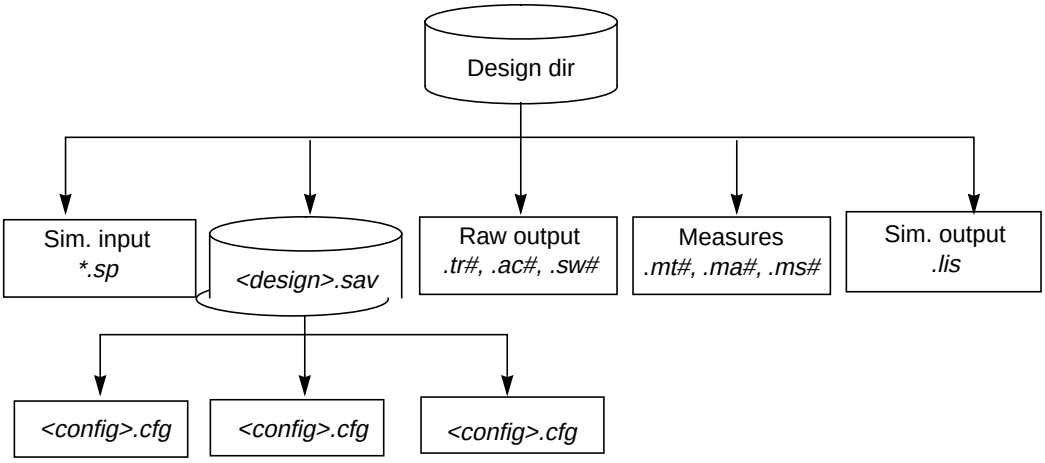
Output Files

At the user's option, AvanWaves can save all design data, analyses and waveforms created to display the data in a "configuration". The user saves each configuration to a configuration file with a unique name, of the form *<config name>.cfg,* in the directory *<design>.sav*.

Directory Structure

The directory structure for AvanWaves is shown in Figure 1-2.

Figure 1-2 Directory Structure



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Getting Started

This chapter provides some simple procedures to help you understand and use the basic functions of AvanWaves.

Starting AvanWaves

1. Setting up your demo environment

   Change directory to *$installdir/demo/awaves*.

2. Loading AvanWaves

   AvanWaves can be run under different window manager environments:

   - Using Motif

     Motif is the default environment setting for running the AvanWaves application. Start AvanWaves on the command line from any directory by typing:

     ```
     awaves
     ```

     For backward compatibility purposes, you can also start AvanWaves by typing `mwaves`.

   - Using other window manager environments

     Start AvanWaves on the command line from any directory, specifying the window manager that you are using, as follows:

     ```
     awaves -laf [windows|openlook|motif]
     ```

The AvanWaves application is loaded and the Results Display window is displayed under the selected window manager.

Note: This user guide describes AvanWaves behavior under the Motif window manager (default). There will be some differences in user interface appearance and functionality for the other window managers.

For a complete set of invocation options, please see the "Invoking AvanWaves" section on page 4-1.

Using AvanWaves

The following example demonstrates how to use AvanWaves to analyze the results of an Star-Hspice DC analysis for a MOS device, displaying a family of I vs. V curves. The example uses the design *mosiv.sp*, in the *$installdir/demo/awaves/tutorial/dc* directory.

Opening the Design

To open the *mosiv.sp* design:

1. In the Results Display window, select the **Design** → **Open** command, using the right mouse button.

   The Open Design window appears.

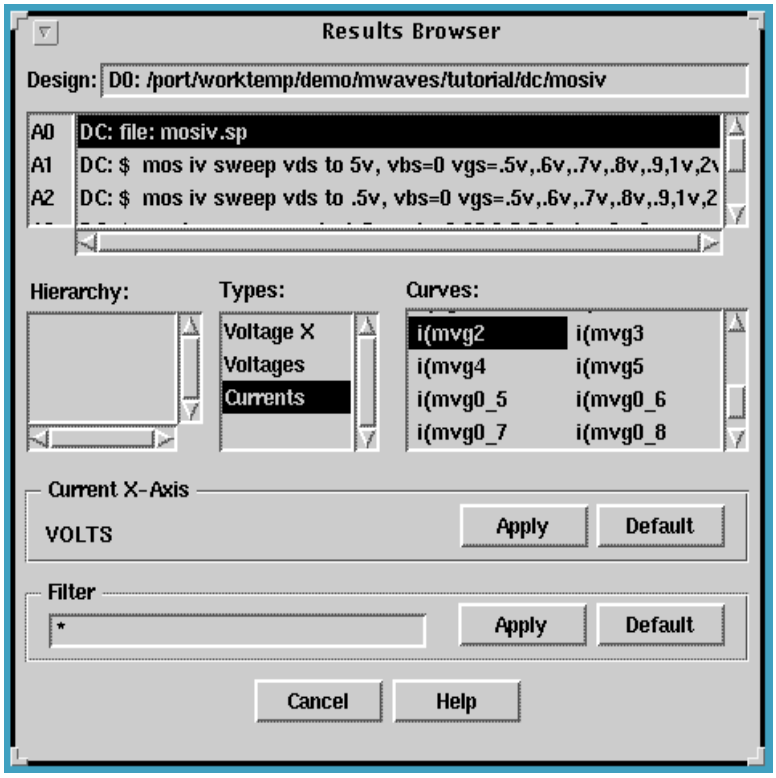
2. In the Open text area, enter the following design file path name:

   ```
   $installdir/awaves/tutorial/dc/mosiv.sp
   ```

3. Click on **OK** with the left mouse button.

   The Results Browser opens as shown in Figure 2-1, listing the analysis files for the design.

Figure 2-1 The Results Browser



Selecting the Analysis Files

The analysis is set up by selecting an analysis file and an analysis type, as follows:

1. In the Results Browser, select the DC analysis, **A0**.

   This is the file to be used in the analysis.

2. In the Types scroll box, select the analysis data type **Currents**.

   A list of all curves associated with the selected data type is displayed in the Curves scroll box.

Displaying a Waveform

Waveforms are displayed in the Results Display window. One panel is opened by default on opening this window. To display the waveform associated with the curve **i(mvg2**, do the following:

- In the Curves section of the Results Browser, select the curve **i(mvg2** with the left mouse button. Then use the middle mouse button to drag and drop it into the panel in the Results Display window.

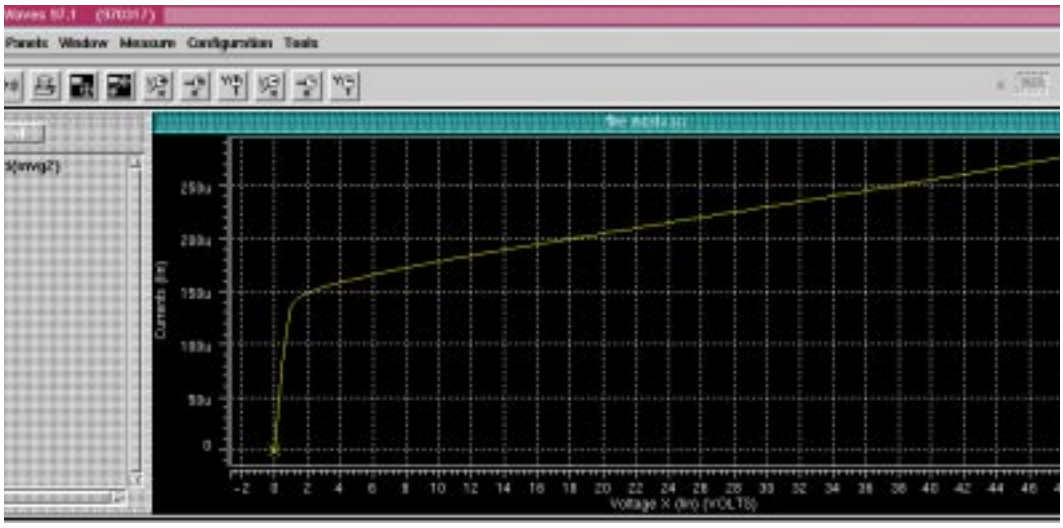
  The selected waveform is displayed, as shown in Figure 2-2.

- As an alternative way of displaying the waveform:

1. With the left mouse button, click on the panel you want to display the curve in.
2. In the Results Browser, double-click with the left mouse button on the name of the curve to be displayed.

   The waveform is displayed in the selected panel.

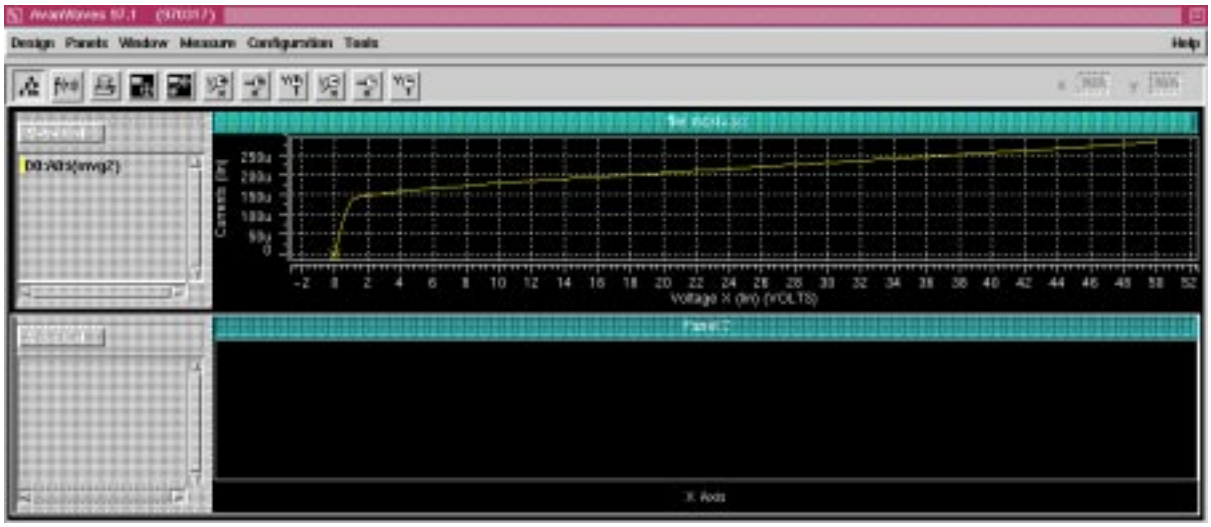
Figure 2-2 i(mvg2 curve Displayed in the Results Display window



Adding a New Panel

A number of panels can be opened in the Results Display window at the same time, which provides a way to do comparisons. To add a new panel to the Results Display window, select **Add** from the Panels pulldown menu. A new panel is added to the Display area, as shown in Figure 2-3. Panels are automatically named as they are added.

Figure 2-3 Results Display Window with Addition of New Panel



The number of panels displayed in the Results Display Window is only limited by the size of the Results Display window. If the window size is too small, the following message is displayed when you select **Add** from the Panels pulldown menu.

```
Not enough room to display new panel. Added as hidden
panel.
```

The panel is added to the Panel List within the Panels pulldown menu as a hidden panel. To display the panel, increase the size of the Results Display window, then double-click on the hidden panel.

Displaying a Second Waveform

To display a second waveform in the new panel:

1. Click the L mouse button in the new panel to select it.
2. In the Results Browser, select the DC analysis **A1**.
3. In the Types section, select the analysis data type **Currents.**

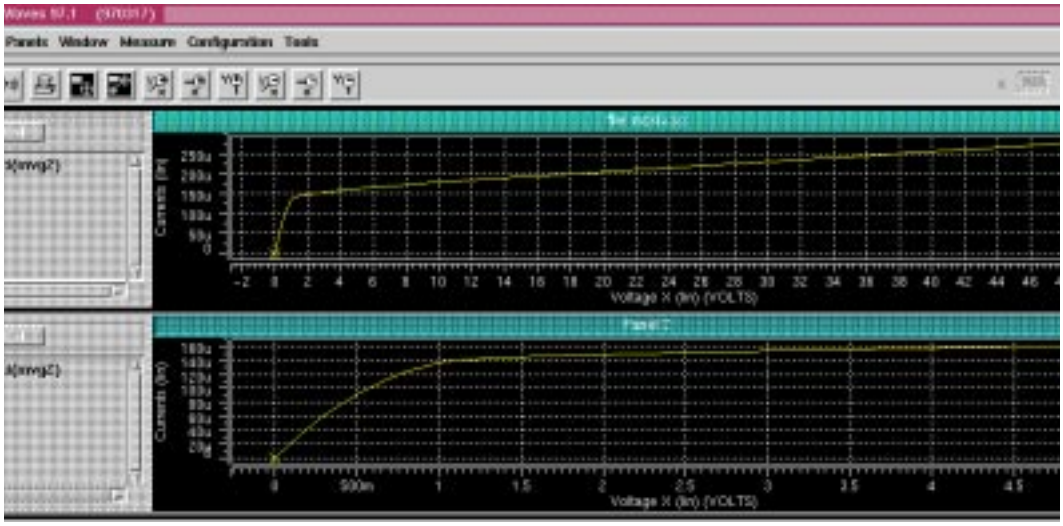
   In the Curves section of the Results Browser, select **i(mvg2** using the L mouse button, then double click the L mouse button to produce the curve in the selected display panel, as shown in Figure 2-4. Alternatively, you can drag the selected curve into the panel in the Results Display window using:

   L mouse button (OpenLook desktop)

   middle mouse button (Motif desktop)

To delete a waveform in a panel, select the waveform in the wave list and press **Del**.

Figure 2-4 Two curves displayed in two panels



Repeat steps 1 through 3 to display the curve **i(mvg2** for the other analyses A3 to A5. Now you can compare the waveforms produced by the different types of analysis.

Summary

This example described how to open a design, select analysis files to evaluate, add panels, then display waveforms. These are the basic functions provided by AvanWaves.

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Working With Designs

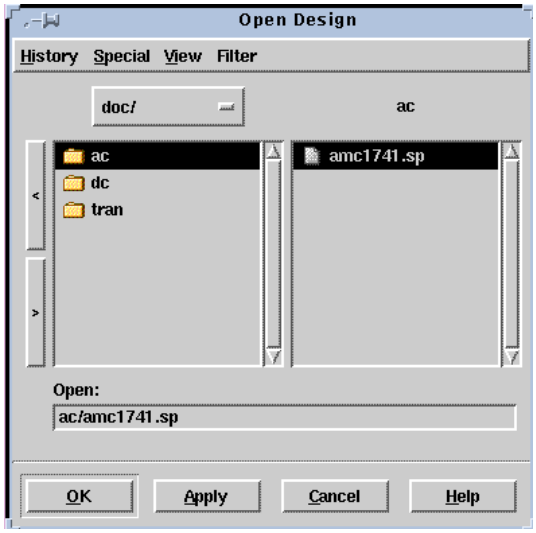
A design is the collective information that describes your circuit, such as the netlist, the analysis files, and the simulation graph data files. This chapter describes the operations you can perform in AvanWaves using the Design menu. This includes opening, closing, and saving designs.

Using the Open Design Window

The Open Design window shown in Figure 3-1allows you to open one or more designs in AvanWaves. The window has a menu bar with four menus, a pop-up directory selector button, lists of directories and files, scrolling buttons for the lists, and an Open field.

To select a directory, click and hold down the pop-up directory selector button, and slide the selector to the directory name. The left-hand list shows the contents of the directory you select. If the item selected in the left-hand list is a directory, the contents of that directory are shown in the right-hand list.

Figure 3-1 The Open Design Window



To open a design:

1. From the results display window, select **Design** → **Open**.
2. In the Open Design window directory selector pop-up menu, select the directory that contains the design you want to open. This is the *run* directory.
3. If the design file is in a subdirectory of the *run* directory, select the subdirectory in the left-hand list area in the Open Design window.
4. In the right-hand list area, select the simulation file you want to open.

   On opening the design, AvanWaves collects all of the files associated with this design (the Star-Hspice input and output files and the other associated files having the same design root name) from the path specified.

You can navigate through the directory structure in the following ways:

- Enter a path and design name into the Open field in the dialog box.
- Double click on a directory to display its contents.

- Use the < button to select the parent directory or use the > button to select a subdirectory.
- Use the History menu to select designs that you have previously visited.

- Select a path from the pop-up menu. This menu always contains the name of your current directory.

To open the design, double click on the design name or select the design from the file list displayed, and then click **OK or Apply**.

Selecting Menus

The following selections can be made in the Open Design window:

History Menu

Select the History menu to get a list of the paths to designs previously visited in this AvanWaves session. The maximum number of paths that can be displayed is five. The first item in the list is the path to the current design. Selecting one of the paths from this list opens the selected design and close the currently-active design. The History list is updated whenever you use the **Special** → **Mark** or **Special** → **Unmark** command.

Special Menu

Select the Special menu to

- Return to your home directory
- Mark a directory location for permanent entry in the History list
- Remove the current directory location from the marked list

View

Select the View option to change the order in which file names are displayed in the file list. You can display files

- **by Name** — Lists the files by name in alphabetical order
- **by Date Modified** — Lists the files according to the last date they were modified
- **by Date Created**— Lists the files by the date created

Filter Menu

Select the Filter menu to limit the number of files selected by selecting the types of files displayed in the file list. There is a file extensions submenu that lets you specify the default extension to the Star-Hspice input netlist (defaults to **.sp*). The Filter menu lists six types of files, with a button for each type. When a button for a file type is clicked, that type of file is selected for display. A button that is not depressed means that type of file is not selected. Any combination of file types may be selected.

The six file types in the Filter menu are

Input	Display input files only
Listing	Display listing files only
Raw Output	Display raw data files only (Star-Hspice graph data files: **.tr0*, **.ac0*, **.sw0*, **.cw*, **.wv*, **.xp*)
Measures	Display measure data files only (**.mt0*, **.ma0*)
All Files	Display all the files in the current directory
Options	Display the filename extensions for input and history files

Buttons

The available buttons are

OK	Click **OK** after selecting the design from the list to open the design and close the Open Design window.
Apply	Click **Apply** after selecting the design from the list to open the design without closing the Open Design window. To close the Open Design window, you must click **Cancel**.

Cancel	Click **Cancel** to cancel the current operation and close the Open Design window.
Help	Click **Help** to get the AvanWaves on-line Help on the current dialog box.

Accepted File Types

Design files are Star-Hspice simulation input or output files that are used as input to AvanWaves. You can open a design file by specifying the path to the design files, then selecting the file type on the Filter menu. AvanWaves accepts these file types:

Design File Name	**Description**
<*design*>.*sp*	the Star-Hspice input netlist
<*design*>.*st0*	the status file
<*design*>.*lis*	the output listing file
<*design*>.*tr#*	raw transient simulation output data
<*design*>.*sw#*	DC analysis graph data file
<*design*>.*ac#*	AC analysis graph data file
<*design*>.*mt#*	transient measure data file. An associated *design.tr#* file must exist for this file to be current.
<*design*>.*ms#*	DC measure data file. An associated *design.sw#* file must exist for this file to be current.
<*design*>.*ma#*	AC measure data file. An associated *design.ac#* file must exist for this file to be current.
<*design*>.*cw#*	Transient output data from Star-Sim.
<*design*>.*wv#*	Transient output data from Star-Sim.
<*design*>.*xp#*	Transient output data from Star-Sim.

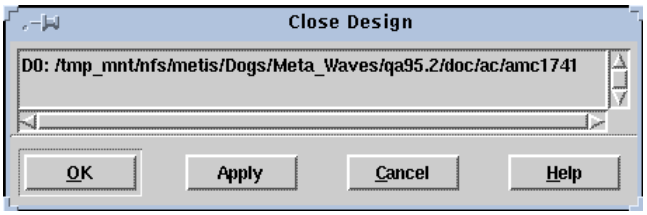
Using the Close Design Window

The Close Design window lists all designs you have opened in your current AvanWaves session.

To close a design,

1. From the Results Display window, Select **Design** → **Close**. The Close Design window appears, as shown in Figure 3-2.
2. Select the design that you want to close, then click **OK** or **Apply**. Double clicking the design has the same effect as clicking **Apply**.

Figure 3-2 Close Design



Buttons

The available buttons are

OK After selecting the design from the list, click **OK** to close the design. This removes the design from the current session and closes the Close Design window.

Apply After selecting the design from the list, click **Apply** to close the design. This removes the design from the current session. You must click **Cancel** to close the Close Design window.

Cancel Click **Cancel** to cancel the current operation. This closes the Close Design window.

Help Click **Help** to get the AvanWaves on-line Help on the current dialog box.

Using the Current Design Window

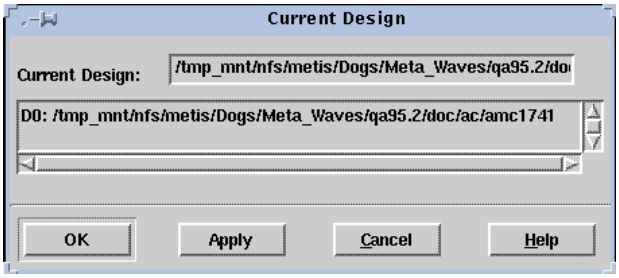
The Current Design window lists all the open designs in your current AvanWaves session. It provides the full path name to the design. You can select a new current design from the list of designs. Setting the current design refreshes the Results Browser with the current design data.

Designs are represented by design numbers *D0* through *Dn*. The design number is the identifier for your design and is referenced throughout the application. It is used to identify displayed waveforms.

To select a new current design:

1. Select **Design** → **Current** from the Results display window. The Current Design window appears, as shown in Figure 3-3.
2. Select a design.
3. Click **OK** or **Apply.**

Figure 3-3 Current Design



Buttons

The available buttons are

OK Click **OK** after viewing the current design or after selecting a new current design. The new design is automatically loaded into AvanWaves. Double clicking on the design has the same effect as clicking **OK**.

Apply Click **Apply** to apply any changes you made. If you selected a new design, the new design is brought in as your current design. You must click **Cancel** to close the Close Design window.

Cancel Click **Cancel** to cancel the current operation and close the Current Design window.

Help Click **Help** to get the AvanWaves on-line Help on the current dialog box.

Exiting the Design

To close the design and quit the AvanWaves application, do the following:

1. Select **Design** → **Exit** in the Results Display window.

   The Exit AvanWaves dialog box is displayed. You are given the option of saving your current design configuration before quitting. Refer to Chapter 7, “Using Configurations,” for information about saving and restoring AvanWaves configurations.

2. To save your design configuration, click **Save**.

   The Save Configuration dialog appears.

3. Enter the name of the configuration, then click **Save** in the Save Configuration dialog. This saves your design to the configuration specified, and then exits the AvanWaves application.

Avant!

4

Understanding the User Interface

This chapter describes the AvanWaves user interface, which includes the command line invocation, mouse operations, and the menus and tools used to perform operations on the simulation results. A list of keyboard shortcuts also is provided for the most commonly used commands.

Invoking AvanWaves

AvanWaves is invoked on the command line using different options. The full command line syntax is:

```
awaves [[-d] <path><design_name> [-c <config_name>]]
[ -laf ( windows|openlook|motif ) ]
```

The options are described as follows.

-d <design_name>	Specifies the name of the design to be opened on invoking AvanWaves. The design name is specified using Star-Hspice file extensions, such as *.sp, .lis, .tr0, .tr1, .tr2, .ac0, ac1, .ac2*. An example of a design name is *design1.sp*.
-c <config_name>	Specifies that a previously saved configuration for the current design is to be used upon the initialization of AvanWaves. The -d option with the

design name corresponding to the configuration name must be specified on the command line.
For example, if *D1.sav/BodePlot.cfg* is saved in a previous session, then to open the design and the saved configuration you can use one of the following command line options:

```
awaves -d D1 -c BodePlot
```
or
```
awaves -d /mytop/D1 -c BodePlot
```

laf [windows | openlook | motif]
Specifies the window manager style to be used. The default is Motif.

After invoking the awaves command, the copyright information appears first, as shown in Figure 4-1, then is replaced with the Results Display window.

Figure 4-1 AvanWaves Copyright Information

Avant!
AvanWaves B7.1 (970317)
Copyright 1996 Avant! Corporation All Rights Reserved
Copyright 1995, Visix Software Inc., All Rights Reserved
(Galaxy Run Time Components Only)
This computer program is protected by copyright law and
international treaties. Any dissemination or use of this program,
other than that permitted by Avant! Corporation, is unlawful
and may result in prosecution under the law.

Using the Mouse

The mouse is used for selecting items and menu options in AvanWaves. The following describes the use of the mouse buttons for Motif UNIX system users.

Select item (“click”)	Using the left mouse button, click once on the item to select it. This mouse button is used to perform operations inside panels, such as measures and zooming.
Select menu (“select”)	Use the right mouse button to make menu selections, including context-sensitive menus.
Double-click	Using the left mouse button, click twice on the item to be selected or displayed. This action opens or expands an item.
Drag and drop	Using the left mouse button, click on the item to select it. Then press and hold down the middle mouse button while dragging the selected item. Release the button when the item is in the desired location.
Multi-select	While pressing **Control**, click on the desired items one after the other with the left mouse button. The group of items is selected.
Range select	Hold down the left mouse button and drag the mouse over the required range, then release the mouse button.

Tools Description

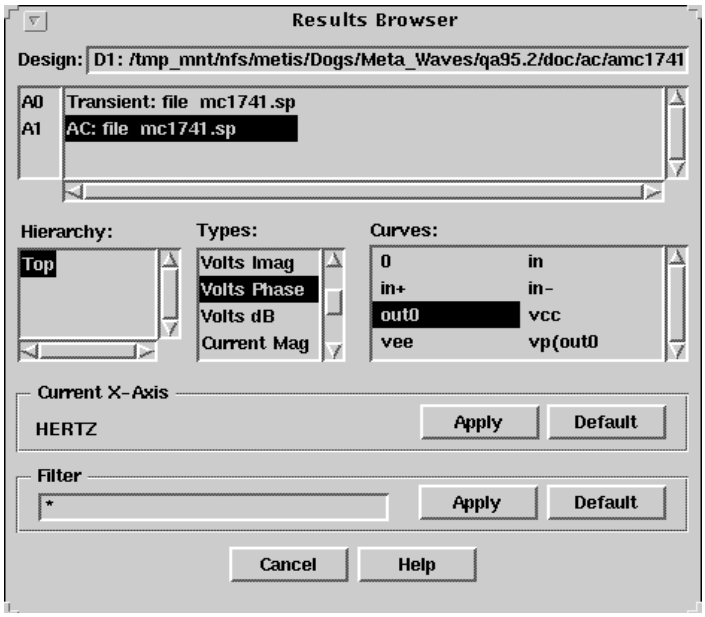
The user interface for the tools available in AvanWaves is described in this section. A list of the tools and a brief description of each one follows.

Results Browser	Dialog box for displaying the available analysis files and their types for a particular design
Results Display window	The main window used for displaying waveforms and information about the displayed waveforms
Expression Handler	Dialog box for creating expressions that you can use to analyze simulation results
Macro Builder	Dialog box for creating macros to be used in your expressions
Print	Controls printing of the contents of a panel
Preferences	Sets general application preferences such as foreground and background color, font, and waveform display attributes
Sweep Filter	Dialog box for selecting parameters for displaying waveforms

The Results Browser

The Results Browser is a dialog box that lists all of the available Star-Hspice simulation data for the current design. The simulation data are listed by analysis type.

Figure 4-2 The Results Browser



The following is a description of the components of the Results Browser.

Current Design Field and Scroll List

The path to the current design is displayed in this field at the top of the Results Browser. An analysis label *A0* through A*n* is associated with each set of analysis data for the current design and displayed in the scroll list. Each analysis label is followed by a description consisting of a simulation type and title. The title is derived from the first line of the input file to Star-Hspice or the title specified on the ALTER statement.

To select an analysis, click on the description associated with its label. The types of data available for the current analysis are listed in the Types area of the window, and the variable names are listed in the Curves area. You can change the contents of the Curves field by selecting other analyses in the Types list.

Hierarchy Browser Scroll List

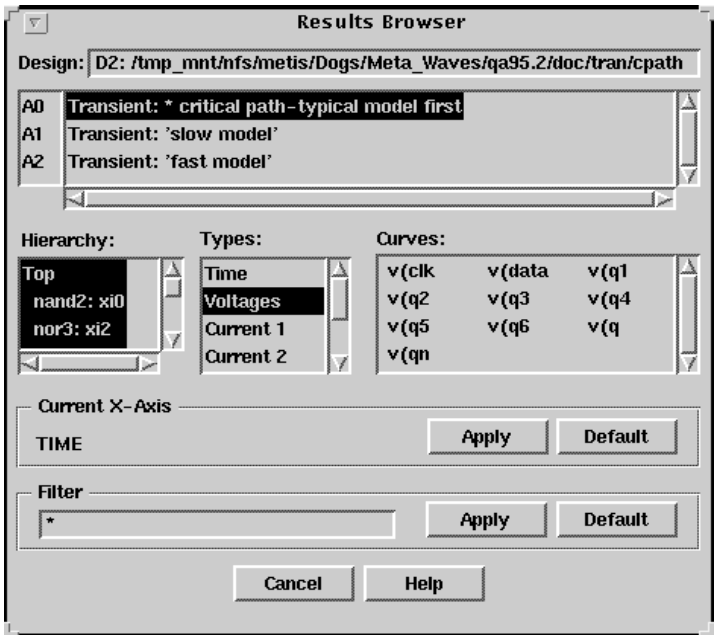
AvanWaves provides a Hierarchy Browser that can be used to reduce the number of nodes that the user sees during curve selection in the Results Browser window. The Hierarchy Browser is a listbox in the Result Browser, as shown in Figure 4-3. This box displays the subcircuit hierarchy of a design. AvanWaves reads hierarchy information from either the <*design*>*.lis* or <*design*>*.pa0* output files from the Star-Hspice run. Not all circuits have a subcircuit hierarchy. If there is no hierarchy in the design, the hierarchy window is blank.

Subcircuits are shown in the form “instance_name: cell_name” if the *.lis* file is available. If only the *.pa0* file is available, only the instance name is shown. The *.pa0* file does not contain cell names.

The user can perform two types of operations with the hierarchy window.

- Subcircuit hierarchies may be turned on and off by double clicking the parent.
- The set of subcircuits from which nodes are displayed is chosen by selecting subcircuits in the hierarchy window. Multiple subcircuits can be chosen by using the Multi-select or Range select features (see “Using the Mouse” section on page 4-3.)

Figure 4-3 Hierarchy Browser with multiple subcircuits selection



Types Scroll List

The Types list displays the types of data available in your current analysis. Selecting the data type changes the contents of the Curves list to indicate the data available.

Click on one of the Types in the list to select it.

For more information on Types, refer to the *Star-Hspice User's Manual*.

Curves Scroll List

The Curves area lists the data that is available for a selected type of analysis. After you select a data type in the Types area, a list of available data is displayed in the Curves scroll list.

You can display the waveform associated with the curves by

- Selecting the required curves and drag the selections into a panel.

  or

- Double-clicking on a node to display it in the selected panel.

Current X-Axis Selector

The Current X-Axis represents the variable and units to be used on the horizontal axis to display the waveform in the panel. The default X-Axis is the first independent variable in the Types list. You can modify or change your X-Axis variable as follows:

1. Drag a curve from the Curves section into the Current X-Axis box.
2. Select a curve and click **Apply** in the Current X-Axis box.
   The X-Axis used with this curve is now used as the current X-Axis variable for the selected curve.
3. Click **Default**. This resets the value to the default value.
   The default value is the first variable that appears in the Types list.

Filter Selector

The Filter is used to select data points based on criteria entered by you for displaying in the Curves area. You can enter your selection criteria in the Filter field. Regular UNIX expressions (*, .) are accepted. Click **Apply** to apply your selection as a filter for the curves. Click **Reset** to display the default values in the curves area for your analysis.

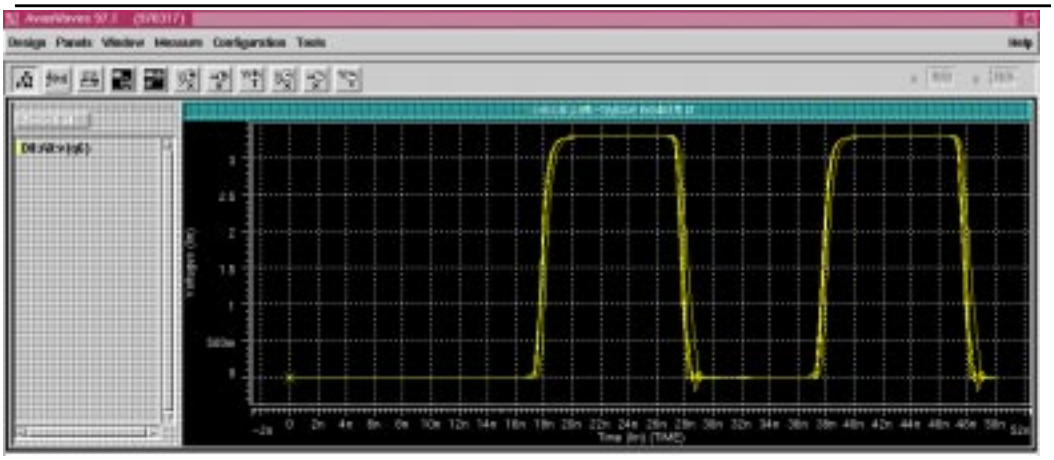
The Results Display Window

The Results Display window is the primary application window containing the menus, options, functions, and tools that you need to perform your simulation analysis. The Results Display window contains these components:

- Menu bar
- Speed bar
- Panel(s)
- Wave List
- Context-sensitive menus

The components of the Results Display window are described in the following sections.

Figure 4-4 Results Display window

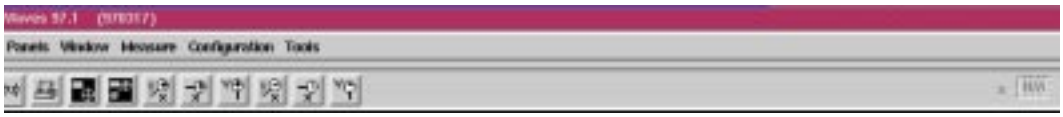


The Window banner conforms to the standards of the resident window manager for your machine, such as Motif or OpenLook.

The Menu Bar

The Menu bar is located at the top of the Results Display window and contains six pull-down menus and a Help button.

Figure 4-5 Menu bar



The Menu bar contains these pop-up menus:

Design	Use to open and close a design, exit from a design, and display your current design.
Panels	Adds, deletes, hides and updates panels.
Window	Performs zooming and panning operations. These operations change the view in the panel.

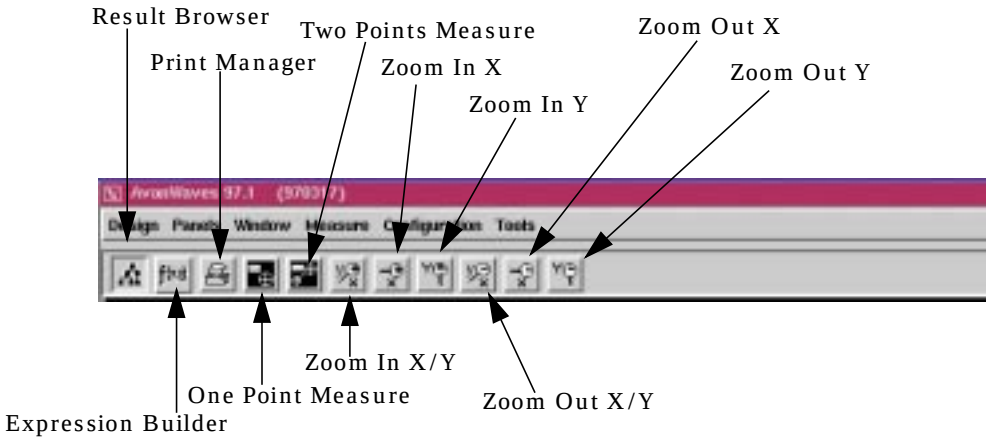
Measure	Performs point or point-to-point measurements on waveforms and deletes measurements.
Configuration	Opens, saves, and deletes configurations.
Tools	Provides tools to perform analyses of your design.
Help	Provides on-line Help for AvanWaves.

The Speed Bar

The speed bar is located between the menu bar and the panel. It contains the following two types of items:

- Accelerator icons are used to make a quick selection of the Results Browser, Expression Handler, and Print functions. To select a function, click on the icon representing the function to open the associated dialog box.
- The X-Y coordinate display is used to display the position of the cursor during a measure operation. The X and Y coordinates of the cursor, shown on a waveform by the measure markers, are displayed in the boxes.

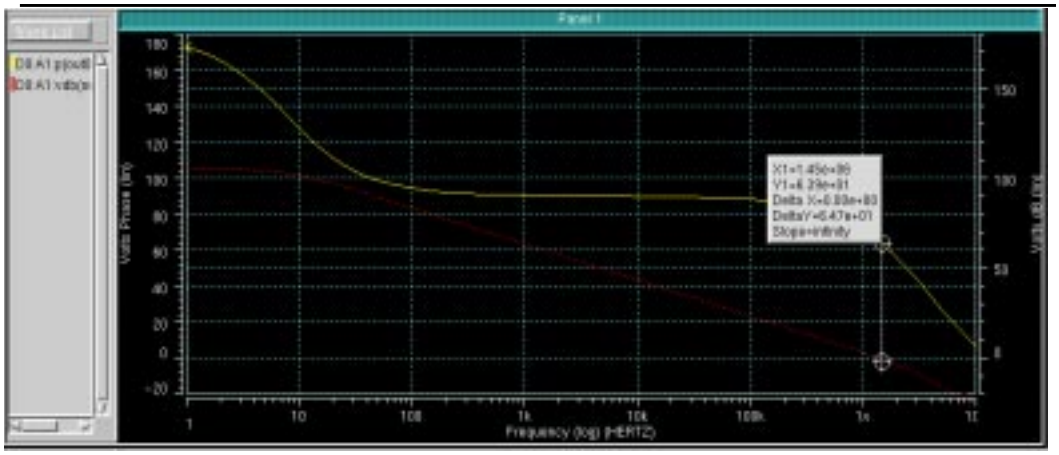
Figure 4-6 Speed bar



The Panel

Panels contain waveform displays in the AvanWaves Results Display window. A panel consists of a panel name, a Waveform Display area, an X-Axis and a Y-Axis, and a Wave List. The waveforms can be raw simulation data, measurements, or results of an analysis using expressions and operations on simulation data. A panel also has two context-sensitive pop-up menus associated with it. Panels can be added to or deleted from the Results Display window. Panels can be switched from one view type to another. You can save all information and status of a panel in a "configuration."

Figure 4-7 A Panel



The following is a description of the components of a panel:

Panel name — Each new panel is opened with a default panel name such as 'Panel 1'. You can change the panel name by deleting the default name and typing a new one. Panel names are displayed in the Panel List in the Panel pulldown menu. To delete a particular panel, select the panel name and click the Delete key.

Waveform Display area — the display area inside the panel where simulation data and analyses are displayed.

X-Axis	The horizontal X-Axis and the associated units are displayed when waveform data is shown in the panel. A context-sensitive menu is associated with this axis. You can select this menu by pressing the right mouse button on the X-Axis. You can change the scale of the X-Axis display.
Y-Axis	The vertical Y-Axis and the associated units are displayed when waveform data is shown in the panel. A context-sensitive menu is associated with this axis. You can select this menu by pressing the right mouse button on the Y-Axis. You can change the scale of the Y-Axis display.

Each waveform has a unique color associated with it as an identifier. The color used in the waveform is the same color used to identify it in the Wave List. There is a standard set of colors assigned to waveforms as they are added to a display. The color set can be modified through the Preference option on the Tools menu. Eight different colors can be used at a time from a set of 16 colors. Waveform names can be no longer than sixteen characters in length, according to the Star-Hspice limit for relative waveform names.

Panels also can be hidden from view. If the number of panels displayed has reached the limit of eight, then each new panel above the maximum number is added to the Panel List as a hidden panel. Hidden panels are grayed out in the list. Panels currently displayed are highlighted in the list. To display a hidden panel, one of the panels currently displayed must either be hidden or deleted. These operations can be selected from the panels menu.

*Note: You must select a panel by clicking in the panel before you perform an operation on it. A number of panels may be selected at a time by holding down the **Control** key while selecting the panels.*

Add Label

Use the **Panels** → **Add Label** utility to add your own labels to waveforms:

1. Click the left mouse button on **Add Label**, or type Ctrl-L, to display the Label Name dialog window.
2. Type your label into the Label: field of the Label Name window.
3. Click **Apply** to preserve the Label Name window if you want to apply another label after this one. Click **OK** If your label is either singular, or the last one of a set. When you move your cursor into the waveform display area, AvanWaves displays your label with your cursor arrow.
4. Click the left mouse button to place the label in any position in the display area.

Delete Label

Delete labels using **Panels → Delete Label.** Select the label by clicking on it with the left mouse button and then click on **Delete Label**, or type Ctrl-2, to delete it.

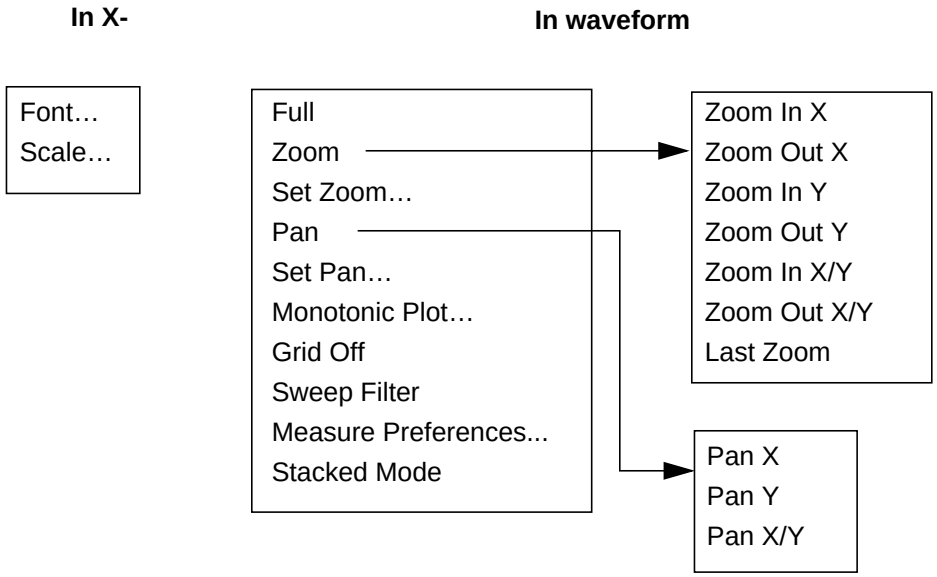
The Wave List

The Wave List is located on the left side of the Results Display window associated with each panel. All waveforms currently displayed in the waveform display area of the panel are listed. You can scroll through the Wave List if not all waveform names are visible.

The Context-Sensitive Menus

Context-sensitive menus are pop-up menus that are available in a particular area of the panel. That is, a particular pop-up menu appears depending on the location of the cursor in the window. The areas that have context-sensitive menus in the Results Display window are the X-Axis, the Y-Axis, and inside the waveform display area. Activate the context-sensitive menus by clicking in the context-sensitive area with the right mouse button.

Figure 4-8 Context-Sensitive menus



Context-sensitive menus in X-Axis and Y-Axis areas

The context-sensitive menus for the X-Axis and Y-Axis provide the option to change the scale used in the graph area. Select this option to display a dialog box with toggle buttons from which you can choose a Linear or Logarithmic Scale. Select the scale you want with any of the mouse buttons, then click **Apply** to enforce it.

Context-sensitive menus in waveform display areas

The context-sensitive menu for the waveform display area provides all the options available on the Window menu in the main menu bar, in addition to the following options:

Set Zoom Calls up a dialog box in which you can set values for zooming. The X-Axis and Y-Axis scales are defined here. You can set specific zooming options, having minimum and maximum values.

Set Pan Calls up the **Set Local Pan** dialog box where you can set values for local

	panning. You can enter values for your axis here.
Monotonic/Continuous Plot	Alters the display of your waveform.
Grid On/Off	Enables you to turn grid line on and off in the panel.
Sweep Filter	Selects the data set to be displayed.
Measure Preference	Enables you to set the preferences for performing measure operations.
Stacked Mode	Displays curves one above the other with each having its own Y-Axis, rather than overlaying the curves on a single Y-Axis.

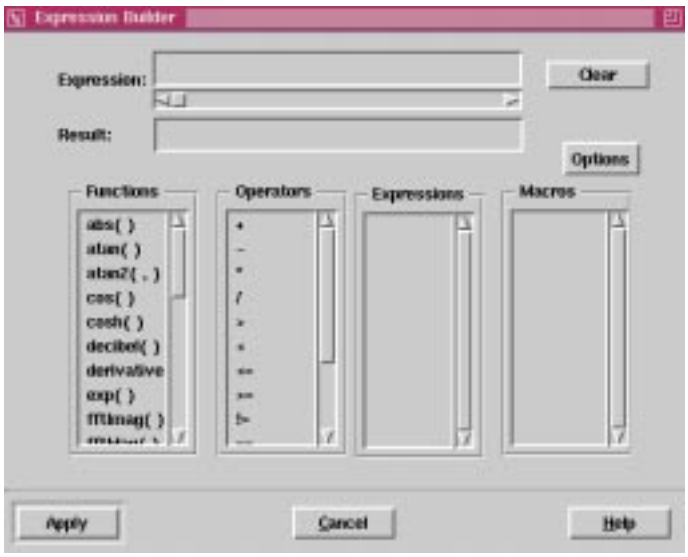
For further information on the commands, see the Command Summary section in Appendix A.

The Expression Builder

The Expression Builder is used to create expressions containing functions, variables, operators, and macros. Expressions are given names and added to the Expressions list.

Enter the Expression Builder by selecting **Tools** → **Expressions** from the Results display window.

Figure 4-9 Expression Builder



Macros also can be created and are added to the Macros list. The results of evaluating expressions can be displayed as waveforms in the Results Display window.

The following is a description of the components of the Expression Builder window:

Expression field

Enter the text for an expression in the Expression field. An expression consists of functions, macros, arguments, and operators. Variables can be selected from the simulation results found in the Curves section of the Results Browser. Expressions can be used to build more complex expressions.

Result field

Enter a name for the expression in the Result field. The expression is saved under this name so that it can be used later. The name is added to the Expressions list.

Clear button

Clears the Expression field and the Result field.

Functions list

The Functions list shows all the system-defined functions that are available for use in creating expressions and macros. Descriptions of the functions and operators available in AvanWaves can be found in Appendix B.

Operators list

The Operators list shows all the predefined operators that are available for use in building expressions and macros in AvanWaves. The following are the types of operators:

- Arithmetic (+, -, *, /) — return analog waveforms
- Comparison (>, <, <=, >=, !=, ==) — return logical waveform results (1 or 0)
- Boolean combination (&&, ||, !) — return logical waveform results (1 or 0)
- Conditional (*expr1* ? *expr2* : *expr3*) — analog value (first parameter is logical)

Expressions list

The Expressions list shows all user-defined expressions.

Macros list

The Macros list shows all the macros created or loaded into AvanWaves. Macros can be selected from this list to be used in expressions, the same way that functions are used in expressions.

Buttons

The available buttons are

Option	Displays the Options Menu
Help	Click **Help** to get on-line Help for the current window.
Cancel	Click **Cancel** to cancel the current operations.
Apply	Click **Apply** to apply the changes made to the expressions and macros.

The Options Menu

The Options pop-up menu provides options for adding, editing, loading, and saving user-defined functions that can be used in expressions. The following options are available in the Macro pop-up menu:

Options → Add Macro	Creates a new macro and adds it to the Macros list.
Options → Edit Macros	Enables you to edit the macro that is currently selected in the Macros list.
Options → Load Macros	Loads previously defined macros into the Macros list to be used in creating expressions.
Options → Save Macros	Saves the current macro to a file.
Options → Delete Expression	Removes the specified expression.

Add/Edit Macro Dialog

The Add Macro dialog is used to add macros to the Macros list in the Expression Builder window. These macros can be used later in expressions.

The Edit Macro dialog is used to edit previously defined macros. A macro must be selected from the list of available macros in the Expression Builder window before selecting this option. The macro selected for editing is displayed in the Edit Macro dialog when the dialog opens.

The Edit Macro dialog has the same user interface as the Add Macro dialog. The user interface for both these options is described below.

Figure 4-10 Add/Edit Macro Dialog

The components of the Add Macro and Edit Macro dialogs are as follows:

Macro Head Enter the name of the macro that you want to define, along with its arguments in this text entry field.

Macro Body The macro body is made up of any number of functions and operators available in the Functions and Operators lists in the Expression Builder window. Expressions are entered into the Macro Body. The expressions entered into the Macro Body may be entered on separate lines and are concatenated into one expression using the operators.

Notes Enter comments on a macro in this text entry field.

Buttons

The available buttons are

OK	Select **OK** to add the macro to the Macros list in the Expression Builder window.
Cancel	Select **Cancel** to cancel the operation.
Help	Select **Help** to get on-line Help on the current window.

Load/Save Macro Dialog

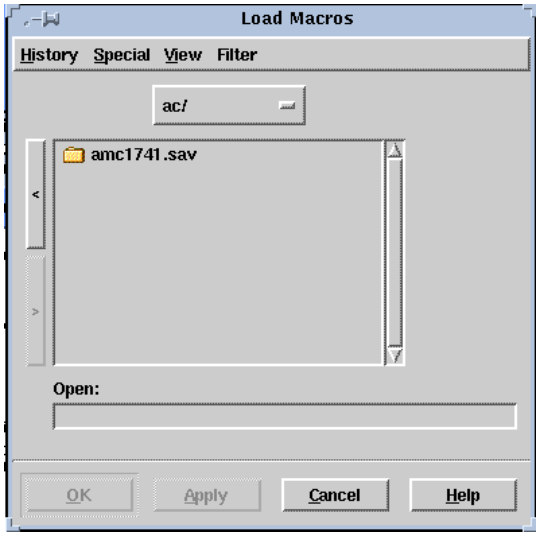
The Load Macro function is used to load previously saved macros into the Macros list. Macros are saved using a *.mac* extension.

*Note: To load a macro that you have saved using a different extension you must select the **Filter** → **All Files** option in the Load Macros dialog to display all the files in the list.*

The Save Macro dialog allows you to save the macros that you created during the current session to a file. This allows you to load and use them in another AvanWaves session with other designs.

The Load Macro dialog has the same user interface as the Save Macro dialog. The user interface for both these options is described below.

Figure 4-11 Load/Save Macro dialog



The components of the Load Macro and Save Macro dialogs are described below.

Load Macros/Save Macros Menus

History

Select this menu item to get a list of the most recent paths used for loading or saving macros. Select one of the paths from this list to load a macro contained in the path or to save a macro to a file at that location. The History list is updated each time you load or save a macro, and it is saved between AvanWaves sessions. The default path is that from which you started the AvanWaves application.

Special

This menu is used in relation to the History menu. It contains the following options:

Home	Returns you to your home directory.
Mark	Marks a directory location for the history list.

Unmark	Removes the current directory location from the marked list.

View

The View option selects the order in which file names are displayed in the file list. Make a selection from the following options:

by name	Lists the files in alphabetical order by name.
by date modified	Lists the files according to the last date they were modified.
by date created	Lists the files by the date created.

Filter

The Filter option allows you to limit the number of files displayed by selecting the file types in the File List. The menu has two buttons. A button that has been clicked marks a selection. A button that is not depressed means that it has not been selected. The following menu options are available:

Macro Definitions	Display macro files only.
All Files	Display all the files in the current directory.

Open/Save field

Open/Save is a text field where you can enter the path to the file you want to open or enter a location where you can save the macro.

Buttons

The available buttons are

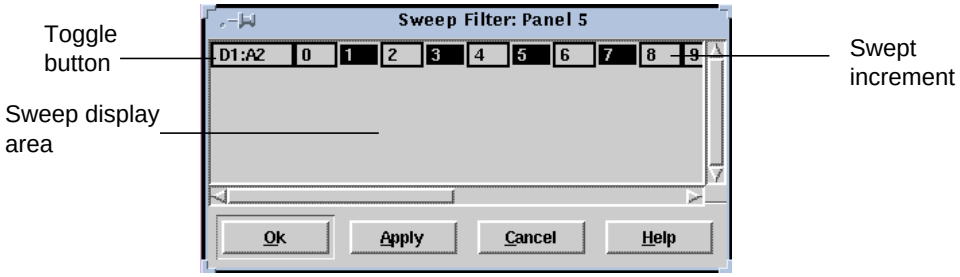
OK	Click **OK** to apply the selection and close the Macro Definitions window.
Apply	Click **Apply** to apply the selection.
Cancel	Click **Cancel** to cancel the current operation.
Help	Click **Help** to get on-line Help on the current window.

The Sweep Filter

In AvanWaves, a sweep is a set of response data with a variation in the value of one of the parameters, such as voltage, resistance, or temperature. Designs can be analyzed by selecting and displaying a set of output data from Star-Hspice simulations (“sweeps”).

The Sweep Filter is used to display the values of a variable for its changing parameters. Sweep increments are displayed on a panel-by-panel basis. The title in the Sweep Filter dialog shows the name of the panel to which the sweeps belong.

Figure 4-12 Sweep Filter



The display area of the filter shows the sweep increments associated with a particular waveform in the current design.

The first entry in the first column in the display area acts as a toggle for selecting or deselecting the sweep increments in the adjoining row. The sweep increments can be selected individually by clicking on them using the left mouse button. The sweep increments also can be selected in groups by holding the **Control** button down while selecting each one using the left mouse button.

Buttons

The available buttons are

OK Click **OK** after selecting the sweep(s) you want to display. This displays the sweep(s) in the waveform display area

	of the panel and closes the Sweep Filter.
Apply	Click **Apply** after selecting the sweeps from the list to display them in a panel. You must click OK or press Return to close the Sweep Filter.
Cancel	Click **Cancel** to cancel the current operation. The Sweep Filter is closed.
Help	Click **Help** to get the AvanWaves on-line Help on the current dialog box.

The Print Dialog

The Print dialog window allows you to print the waveforms displayed in the panels, along with the measurement data and any labels annotating the waveform. Both open and hidden panels can be printed.

Figure 4-13 Print dialog with Print to Printer selection

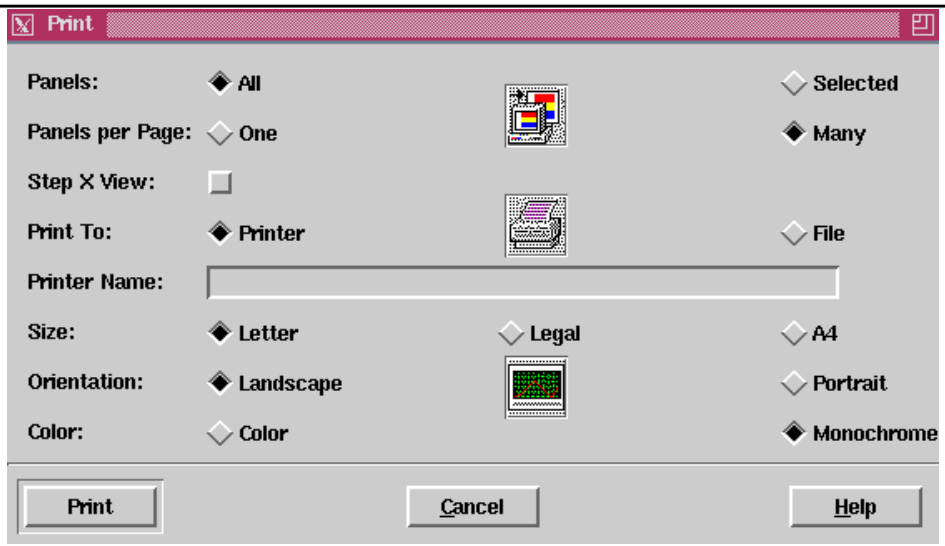
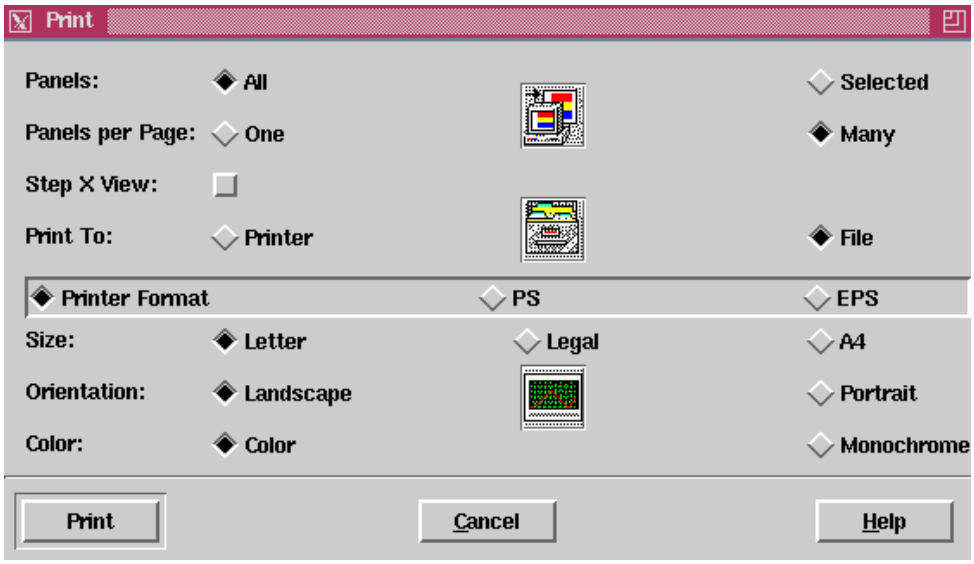


Figure 4-14 Print dialog with Print to File selection



Print

You can make printing selections by clicking on the buttons in the Print dialog. The following options are available:

Panels

Click **All** to print all the panels, including the panels in the Results Display area, as well as the hidden panels.

Click **Selected** to print panels that you have selected from the Results Display area and the Panel List.

Panels per Page

Click **One** to print one panel per printed page. One panel is printed per page for each of the panels selected. There is no maximum number of panels that can be printed using this option. An extended legend containing information about the waveform is displayed across the end of the print, including the design name, the design type, the waveform name, and the symbol used to represent data

	points on this waveform. Click **Many** to print multiple panels on one page. Up to eight selected panels can be printed on a page. An error message is displayed if more than eight panels are selected using the Many option in the Print window. In this case you must go back and reset your print options. A legend is printed out for each panel containing the waveform name, the design analysis tag name, and the symbol used for plotting the data points.
Step X View	Select this toggle if you have a waveform whose view has been altered due to zooming and you want to print the whole waveform. It takes the existing X zoom factor and steps along the X axis from the beginning to the end of the waveform, printing consecutive sections of the waveform. Each section is printed on a separate page.
Print To	Click **Printer** to print a hard copy. This output format depends on the selected print driver. A number of print options are available such as PostScript, Encapsulated PostScript, Generic Output, and All Files. If you click **File** to send the output to a file in PostScript format, this command changes the printer string input field to a set of radio buttons. Refer to Figure 4-14 on page 4-25.
Printer Format	Generates output file of specific printer's format.
PS	Postscript format output.
EPS	Encapsulated Postscript output.
Printer Name	Enter the network name of the printer in this text field.
Size	Select the page size to print a hard copy.
Orientation	Click either **Landscape** or **Portrait** as the page orientation for printing.

Color Click **Color** to print to a color printer.

Click **Monochrome** to get a black and white print.

Buttons

The available buttons are

Print Click **Print** to print the current file selection. If the output is going to a file, a dialog box is displayed for you to specify the location and file name for the output.

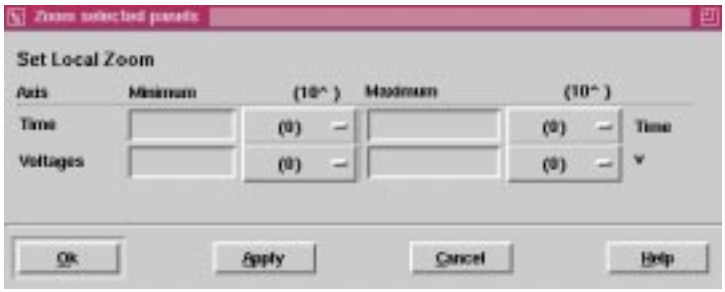
Cancel Click **Cancel** to cancel the current print operation.

Help Click **Help** to get on-line Help on the current dialog.

Set Zoom

Select the **Window** → **Set Zoom** option to display the **Zoom Selected Panels** dialog window shown in Figure 4-15. This window lets you set the zoom factor for zooming in and out of selected areas on the waveform displayed in a panel. The view of the waveform is changed by the ranges selected. The Set Local Zoom option is available on the context-sensitive menu in the panel. Click using the right mouse button to display this menu.

Figure 4-15 Zoom Selected Panels



Axis	Lists the axes displayed in the Results Display window. You can have one X-Axis and up to two Y-axes displayed.
Minimum	Contains the value of the lower limits of each axis. A pop-up menu containing the scale factors is associated with this field.
Maximum	Enter the value of the upper limit of each axis. A pop-up menu containing the scale factors is associated with this field.

Buttons

The available buttons are

OK	Click **OK** to change the view in the panel to that specified.
Apply	Click **Apply** to change the range of the axis to that specified in the Set Local Zoom dialog. You must click **OK** or press. **Return** to close the Set Local Zoom dialog.
Cancel	Click **Cancel** to cancel the current operation.
Help	Click **Help** to get on-line Help on the current dialog.

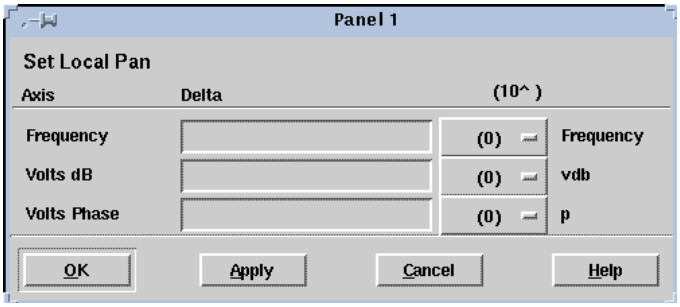
Set Pan

The Set Local Pan dialog allows you to set the values for panning across the waveform displayed in the panel. Panning is very similar to a scrolling operation and you can pan horizontally or vertically by an amount you specify. Entering a positive delta value for the X-Axis shifts the waveform to the right. Entering a negative delta value for the X-Axis shifts the waveform to the left. Entering a positive delta value for the Y-Axis shifts the waveform upward. Entering a negative delta value for the X-Axis shifts the waveform downward.

The Set Pan option is available on the context-sensitive menu in the panel. Click using the right mouse button to display this menu.

Note: Panning operations are performed independently on each axis. When displaying two Y-axes you can set different panning amounts for each axis.

Figure 4-16 Set Local Pan



Axis Lists the axes displayed in the Results Display window. You can have one X-Axis and up to two Y-axes displayed.

Delta Contains the value of the amount that each axis is to be shifted. A pop-up menu containing the scale factors is associated with this field.

Buttons

The available buttons are

OK Click **OK** to change the view in the panel to the view specified.

Apply Click **Apply** to change the range of the axis to the range specified in the Set Local Pan dialog. You must click **OK** or press **Return** to close the Set Local Pan dialog.

Cancel Click **Cancel** to cancel the current operation.

Help Click **Help** to get on-line Help on the current dialog.

Measure Label Options

Choose your preferred label attributes using this dialog window. See the “Measure Label Options” section on page 5-10 for a description of these options.

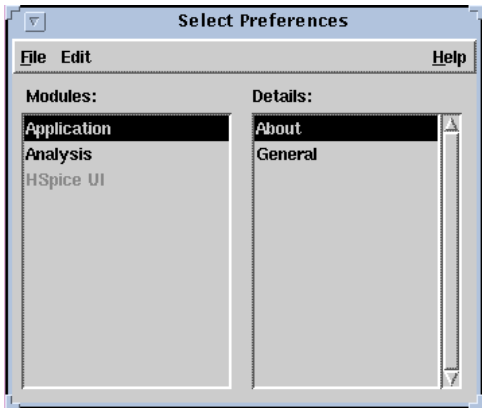
Measure Preferences

From the Results Display window, select **Measure** → **Measure Preferences** to display the Set Measure Preferences window. This window allows you to select different measure options, as well as to select Snap mode when measuring using one or two points. See the “Measure Preferences” section on page 5-9 for a full description.

The Select Preference Window

From the Results Display window main menu, select **Tools**→ **Preferences** to display the Select Preferences window. This window contains a set of menu options that provide general information on the AvanWaves application. Select options on the menus or click on the lists in the dialog box to set the preferences information.

Figure 4-17 The Select Preferences Window



The menu options available in the Select Preference window are summarized below.

File → **Close Window**	closes the Select Preferences window
Edit → **Selected**	(not implemented in this release)
Edit → **Application** → **About**	displays the “About” box for the AvanWaves application, giving version and copyright information

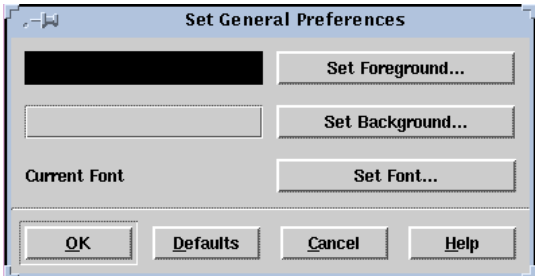
Edit→Application→General	displays a dialog box for setting general application preferences for font, foreground, and background colors
Edit → Analysis → Curves	allows you to set color preferences and continuity for displaying waveforms, the symbol type, and frequency for displaying data points on waveforms

The Set General Preferences Dialog

From the Select Preferences window, click on **Application** → **General** to show the Set General Preferences dialog window**.**

The Set General Preferences dialog allows you to set preferences for foreground and background color and also select the font used for menu and window names and for messages.

Figure 4-18 The Set General Preferences Dialog



Buttons

The available buttons are

Set Foreground	Opens the Color Preference Chooser to set the foreground color.
Set Background	Opens the Color Preference Chooser to set the background color.
Set Font	Opens the Font Preference Chooser to select the font to use in the AvanWaves application.
OK	Click **OK** to apply the selections that you made.
Defaults	Click **Defaults** to use the default settings for each of the items in the window.
Cancel	Click **Cance**l to cancel the current operation and make no changes.
Help	Click **Help** to get on-line Help on the current window.

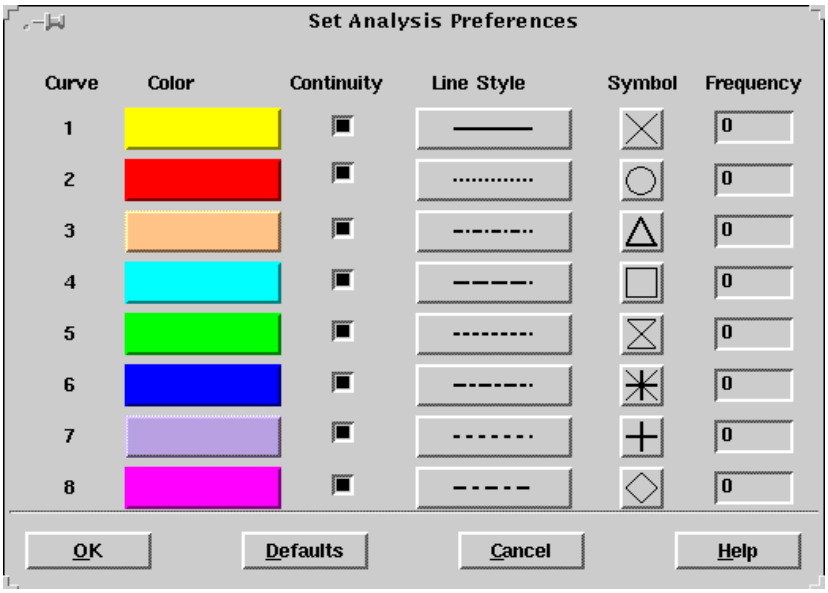
The Set Analysis Preferences Window

From the Select Preferences window, click on **Analysis→ Curves** to show the Set Analysis Preferences dialog window.

The Set Analysis Preferences window is used to select the following waveform display attributes:

- The color of the displayed waveform
- Whether the continuity option is to be displayed
- The line style used to represent the displayed waveform
- The symbol used to represent the displayed data points on a waveform
- The frequency with which the symbols are placed on a waveform

Figure 4-19 Set Analysis Preferences window



Curve

The Curve number indicates the order in which the colors are used to display the waveforms in a panel. Eight colors are allowed, and a cycle is made on the eight colors.

Color

Eight colors are used to display waveforms in the panels in the Results Display window. The waveforms in each panel are considered separately. The colors are organized in a hierarchy, the color corresponding to Curve 1 being used for the first curve displayed, and the color corresponding to Curve 8 being that used for the last curve displayed. If there are more than eight curves, the first color is used again. A default set of colors is available initially. You can change the colors in the set and the order in which they are used.

Click on a color button to show the Color Preference Chooser and select your color choice.

Continuity

Continuity is a toggle button that you can select to display connections between the data points of a waveform. The full waveform and the symbols representing the set of selected data points for the analysis are displayed in the panel. Setting continuity off displays only the symbols representing the data points and no connections. The default value is on. A single click toggles the feature on or off.

Line Style

The line style used to represent each curve is displayed in each panel. Default line style are automatically assigned to the basic set of eight curves.

Click on a Line Style button to show the Line Style Chooser and select from any one of the eight line styles.

To distinguish between different waveforms on monochrome hardcopy plots, you can use a different line style for each waveform.

Symbol

The symbol used to represent the data points on each curve is selected with this function. Default symbols are automatically assigned to the basic set of eight curves.

Click on a Symbol button to show the Symbol Chooser and select from any one of nine symbols.

In order to distinguish different waveforms on monochrome hardcopy plots, you can use a different symbol for each waveform.

Frequency

The setting of Frequency determines how many of the available data points are displayed on a waveform. A frequency of two displays every other data point with a symbol. A frequency setting of 0 means that only the first data point on the curve is displayed.

Type a new number in the Frequency field to make a change.

Setting your Preference

Use the following buttons in the Set Analysis Preferences window to register your choices.

Buttons

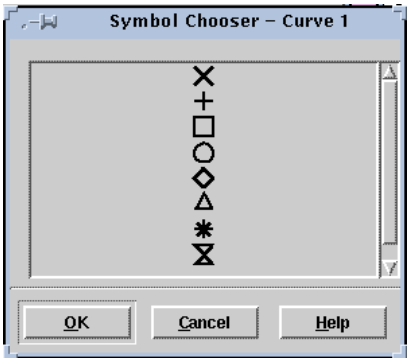
The available buttons are

OK	Click **OK** to apply the selections that you made to the Analysis Preferences and close the dialog window.
Defaults	Click **Defaults** to use the default settings for each of the items in the window.
Cancel	Click **Cance**l to cancel the current operation and make no changes.
Help	Click **Help** to get on-line Help on the current window.

The Symbol Chooser

The Symbol Chooser displays a list of nine symbols that can be used to represent the data points on your waveform. The name of the selected curve is displayed in the title of this window.

Figure 4-20 The Symbol Chooser



Buttons

The available buttons are

OK Click **OK** to change the current symbol to the newly selected symbol.

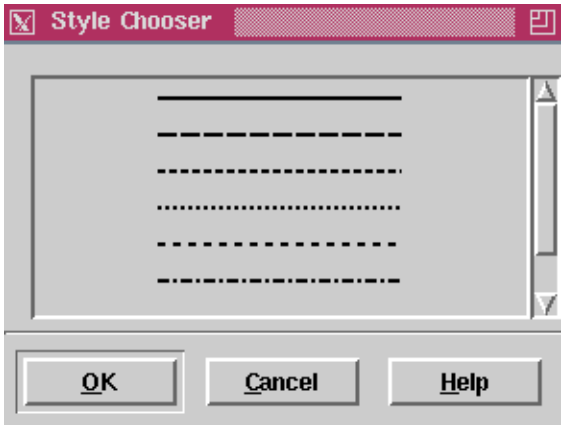
Cancel Click **Cancel** to cancel the current operation.

Help Click **Help** to display the AvanWaves on-line Help for this window.

Line Style Chooser

The Line Style Chooser displays a list of eight line styles that can be used to represent the waveform. The name of the selected curve is displayed in the title of this window.

Figure 4-21 The Line Style Chooser



Buttons

The available buttons are

OK Click **OK** to change the current symbol to the newly selected symbol.

Cancel Click **Cancel** to cancel the current operation.

Help Click **Help** to display the AvanWaves on-line Help for this window.

Keyboard Shortcuts and Hotkeys

Keyboard shortcuts and hotkeys are used to accelerate specific operations that are normally invoked using a series of menu selections. The table below lists the keyboard keys that are bound to particular functions in AvanWaves.

Table 4-1 Hotkey Definitions

Subject	Keystrokes	Function
Design	**Ctrl + o**	Open Design
	Ctrl + c	Close Design
	Ctrl + 6	Select current design
Panels	**Ctrl + a**	Add Panel
	Ctrl 1	Hide Panel
	Ctrl + Del	Delete Panel
	Del	Delete selected curve in selected panel
	Ctrl u	Update
	Ctrl l	Add Label
	Ctrl 2	Delete Label
Window	**Ctrl + f**	Full Zoom (display complete data set)
	Ctrl + x	Zoom In X
	Ctrl + 3	Zoom Out X
	Ctrl + y	Zoom In Y
	Ctrl + 4	Zoom Out Y
	Ctrl + z	Zoom In X/Y
	Ctrl + 5	Zoom Out X/Y
	Ctrl + t	Last Zoom
	Ctrl + s	Set Zoom
	Ctrl + Shift X	Pan X
	Ctrl + Shift Y	Pan Y
	Ctrl + Shift Z	Pan X/Y

Table 4-1 Hotkey Definitions (Continued)

Subject	Keystrokes	Function
Measure	Ctrl + 8	Measure Point
	Ctrl + m	Measure Point to Point
	Ctrl + 9	Delete Measure
	Ctrl + d	Delete All Measures
	Ctrl + g	Measure Label Options
	Ctrl + i	Measure Preferences
Configuration	**Ctrl + n**	Open configuration
	Ctrl + v	Save configuration
Tools	**Ctrl + b**	Display Results Browser
	Ctrl + e	Display Expression Builder dialog
	Ctrl + p	Display the Print dialog
	Ctrl + Shift + u	Display Preference Manager dialog
	Ctrl + h	Run Star-Hspice – displays the Run Manager dialog

Avant!

5

Viewing Waveforms

This chapter describes the functions available in AvanWaves to change the view of the current waveforms displayed in panels. Views of waveforms are changed by selecting zooming and panning operations from the Windows menu.

Changing Views in a Panel

The Window menu items are global operations, in that the operations can be applied to any number of selected panels at a time. The Window menu options change the view of the waveform displayed in the panel. These options follow.

Full

Select **Full** to display the complete waveform in the waveform display area.

Zoom In X

Select **Zoom In X** to magnify the area selected on the waveform. The panel view then changes to that of the selected view. Selections can only be made in relation to the X-axis. This is horizontal zooming.

To zoom into a specific area of the waveform:

1. In the Results Display window, select **Window** → **Zoom In X**.

This displays a “magnifying glass” cursor inside the waveform display area in the Panel. This type of cursor is used to specify the direction (left or right) and the distance on the X-axis that you want to select for zooming in the waveform display.

2. Position the cursor at the start of the area you want to select. Then, holding the left mouse button down, drag the cursor over the distance you want to select for zooming. Release the button when you have selected the area.

   The line defines the waveform area that you want presented in more detail. The previous panel view changes to the selected view.

Zoom Out X

Select **Zoom Out X** to display the results window to a reduced scale. This command only provides horizontal zooming.

To zoom out in a waveform display:

1. In the Results Display window, select **Window** → **Zoom Out X**. This action displays a “magnifying glass” cursor inside the waveform display area of the panel. This cursor is used to specify the X-axis start coordinate and the amount of zoom-out required for the resultant display.
2. Position the cursor at the point you want to be the start of the zoomed-out display and, depressing the left mouse button, generate a line by dragging the cursor from left to right over the section of display that you want to include in the result. Release this button to generate the new view. You can draw the line from right to left but the left-hand end of this line still becomes the start point for the resultant display.

   AvanWaves zooms out the display to a new X-axis scale length equal to the ratio of X-axis scale length to the length of the line dragged by the mouse.

Zoom In Y

Select **Zoom In Y** to zoom into the area selected on the waveform. The panel view then changes to that of the selected view. Selections can only be made in relation to the Y-axis. This is vertical zooming.

To zoom into a specific area of the waveform along the Y-axis:

1. In the Results Display window, select **Window → Zoom In Y**.

   This displays a magnifying glass cursor inside the waveform display area in the Panel. This type of cursor is used to specify the direction (up or down) and the distance on the Y-axis that you want to select for zooming in the waveform display.

2. Position the cursor at the start of the area you want to select. Then, holding the left mouse button down, drag the cursor over the distance you want to select for zooming. Release the button when you have selected the area.

   The line defines the area of the waveform that you want presented in more detail. The previous panel view changes to the selected view.

Zoom Out Y

Select **Zoom Out Y** to display the results window to a reduced scale. This command only provides vertical zooming.

To zoom out in a waveform display:

1. In the Results Display window, select **Window → Zoom Out Y**. This action displays a “magnifying glass” cursor inside the waveform display area of the panel. This cursor is used to specify the Y-axis start coordinate and the amount of zoom-out required for the resultant display.

2. Position the cursor at the point you want to be the start of the zoomed-out display and, depressing the left mouse button, generate a line by dragging the cursor from bottom to top over the section of display that you want to include in the result. Release this button to generate the new view. You can draw the line from top to bottom but the bottom end of this line still becomes the start point for the resultant display.

   AvanWaves zooms out the display to a new Y-axis scale length equal to the ratio of Y-axis scale length to the length of the line dragged by the mouse.

Zoom In X/Y

Select **Zoom In X/Y** to zoom into the area selected. Selections can be made in both directions. The panel view then changes to that of the selected view.

To zoom into a specific area of the waveform in relation to both the X-axis and the Y-axis:

1. In the Results Display window, select **Window** → **Zoom in X/Y**.

   This displays a magnifying glass cursor inside the waveform display area in the Panel. This type of cursor is used to specify the distance in the X and Y directions that you want to select for zooming in the waveform display.

2. Position the cursor at the start of the area you want to select. Then, holding the left mouse button down, drag the cursor over the distance you want to select for zooming. Release the button when you have selected the area.

   The line defines the area of the waveform that you want to zoom into. The previous panel view then changes to the selected view.

Zoom Out X/Y

Select **Zoom Out X/Y** to display the results window to a reduced area scale. This command provides for area (horizontal and vertical) zooming.

To zoom out in a waveform display:

1. In the Results Display window, select **Window** → **Zoom Out X/Y**. This action displays a “magnifying glass” cursor inside the

waveform display area of the panel. This cursor is used to specify the X-axis and Y-axis start coordinates and the amount of zoom-out required for the resultant display.

2. Position the cursor at the point you want to be the start of the zoomed-out display and, depressing the left mouse button, generate a rectangle by dragging the cursor from left to right and bottom to top over the section of display that you want to include in the result. Release this button to generate the new view. You can draw the rectangle in the opposite direction but the bottom left-hand end of the rectangle still becomes the start point for the resultant display.

   AvanWaves zooms out the display to new X-axis and Y-axis scale lengths equal to the respective ratios of X-axis and Y-axis scale lengths to the lengths of the rectangle sides dragged by the mouse.

Last Zoom

Selecting **Last Zoom** returns to the previous zoom selection. When you select Last Zoom, the panel view changes to display the previously selected zoom area.

Pan X

Selecting **Pan X** displays a cross-shaped cursor inside the waveform display area. This type of cursor is used to specify the direction (right or left) and the distance on the X-axis that you want to move the waveform in the waveform display.

To pan in the X direction:

Select the direction and the distance that you want to move the waveform by dragging the cursor a specified amount to the right or left, while holding the left mouse button down. The waveform is shifted parallel to the X-axis.

Pan Y

Select **Pan Y** to display a cross-shaped cursor inside the waveform display area. This type of cursor is used to specify the direction (up or down) and the distance on the Y-axis that you want to move the waveform in the waveform display.

To pan in the Y direction:

Select the direction and the distance that you want to move the waveform by dragging the cursor a specified amount up or down, while holding the left mouse button down. The waveform is shifted parallel to the Y-axis.

Pan X/Y

Select **Pan X/Y** to display a cross-shaped cursor inside the waveform display area in the Panel. This type of cursor is used to specify the distance that you want to move the waveform in X direction (right or left) and the Y direction (up or down).

To pan in the X and Y directions:

While holding the left mouse button down, drag the cursor a specified amount in any direction. The view of the waveform is shifted by the distance specified in the X and Y directions.

Stacked/Overlay

When AvanWaves is in overlay mode (the default), it generates one X and one Y-Axis and draws each curve in that area. In overlay mode, AvanWaves combines a single X-Axis with a separate Y-Axis for each signal so the curves are stacked up one above the other on the screen. Select **Stacked/Overlay Mode** to toggle between these two display formats. This functionality is also available in the pop-up menu, where the bottom entry will be either **Stacked Mode** or **Overlay Mode**, depending on the mode to which AvanWaves is set.

Note: Y-Axis zooms of the individual plots in stacked mode are possible because each curve has an independent Y-Axis. Switching to overlay mode selects the worst case full scale axis for all curves, but a subsequent toggle to stacked mode restores the saved Y-Axis zoom factors on each curve.

Performing Measurements

The Measure menu is available in the Results Display window. It contains six options — Point, Point to Point, Delete Measure, Delete All Measures, Measure Label options, and Measure Preferences. Measure is used to read specific values from a waveform displayed in a panel. The Measure operation performed on a waveform can provide you with the X and Y coordinates of a point on a waveform displayed in the Results Display window, or the difference in the coordinates of two points selected on a waveform or between waveforms.

When you use **Measure** → **Point** or **Measure** → **PointToPoint**, the X- and Y-axis labels and the coordinates of the cursor location are shown in boxes on the right side of the Results window toolbar. The X-axis label is shown in the leftmost box, the X-axis value of the cursor location is shown in the next box, then the Y-axis label, and finally the Y-axis value of the cursor location.

Measure

The Measure option lets you interactively measure data on your waveform display. Data can be measured on one waveform or between waveforms displayed on the same panel. This interactive measure returns scalar results and displays them on the screen. Measurements are made by placing markers on one or more waveforms.

The following measure functions are available on the Measure menu:

Point	Displays the X and Y coordinates for the point selected on a waveform, and the value of the derivative at that point.
PointToPoint	Displays the delta X, delta Y, and the slope values for the two points selected. Both Point and PointToPoint operations turn on the X/Y coordinate display in the upper right corner of the Results Display window.
Delete Measure	Removes the selected measure markers from the waveform display. To select a marker, hold down the **Shift** key and click with the left mouse

	button on the marker. This is a select/ deselect toggle. To deselect a marker, perform the same operation again.
Delete All Measures	Removes all measures from all selected panels.
Measure Label Options	Sets the display items inside the measure label. The Measure Label Options dialog is displayed.

Anchor Cursor

Selecting this entry enables you to place a set of anchored cursors or adjustable measures on the display. One cursor will be dropped on the next left mouse button press, and the second on the following release of the button. Each of the cursors will appear as a vertical line through all panels that share the same units on the X-Axis.

Note: Because anchored cursors appear in all compatible panels, they allow convenient measurements between panels. The only requirement is units compatibility, not value compatibility, thus all time axes are considered compatible.

While being dragged and after being dropped, the first cursor indicates its X-Axis value at the top of the window and the value of every curve at the point where it crosses the cursor in a label positioned near that crossing. The second cursor indicates these values as well, but also includes a delta value that is the change in the value of that signal as measured from the first cursor.

After both cursors have been placed, either can be picked up and moved again by left clicking on the curve, dragging to a desired new location, then releasing it. Higher accuracy relative measurements might be possible by duplicating a panel and zooming each panel in on a transition and dropping the anchored cursors until one appears in each zoomed in panel. During dragging, only values on the cursor being moved are updated. The deltas are updated after the cursor has been dropped again.

Only one pair of anchored cursors can be on the display at a time. Selecting this entry a second time removes the first pair and initiates placement of a replacement pair.

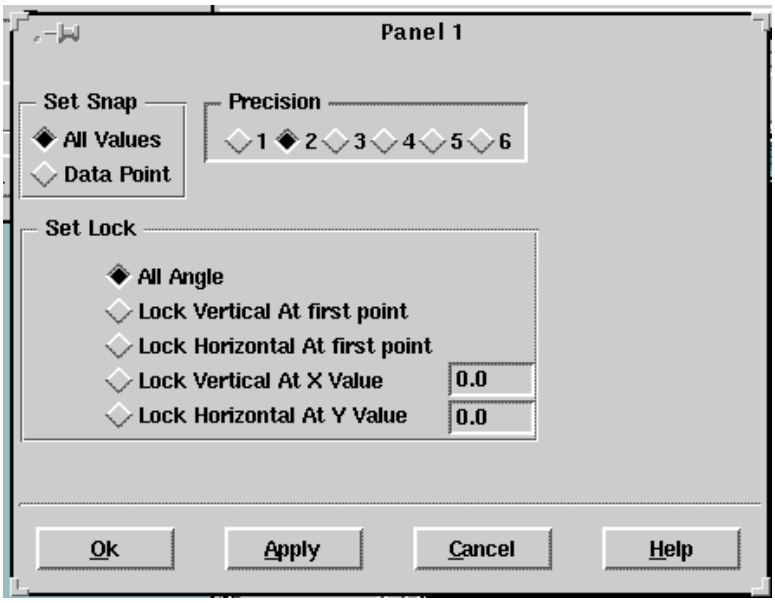
Remove Anchors

This selection removes the anchored cursors from the display.

Measure Preferences

The Measure Preferences window shown in Figure 5-1 allows you to select different measure options, as well as to select Snap mode when measuring using one or two points.

Figure 5-1 Measure Preferences window



These preferences apply to all selected panels.

Set Snap All Values	Snap to interpolated points during measurement.
Set Snap Data Point	Snap to simulation points during measurement.
Set Lock All Angle	No limitation during measurement.

Set Lock Vertical At first point
: Limit measurement to the X (horizontal) direction only.

Set Lock Horizontal At first point
: Limit measurement to the Y (vertical) direction only.

Set Lock Vertical at X Value
: Limit the measurement only on X direction, and lock to the value specified in the string input field.

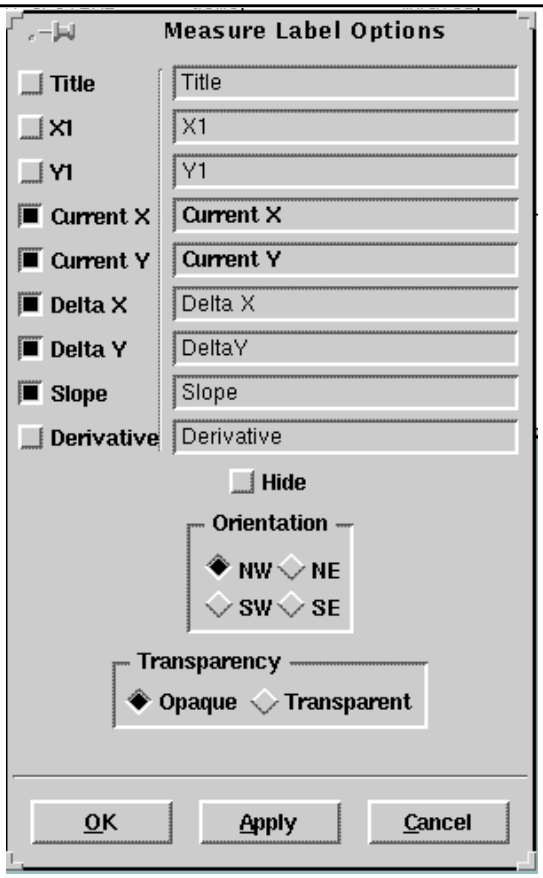
Set Lock Horizontal at Y Value
: Limit the measurement only on Y direction, and lock to the value specified in the string input field.

Precision
: Specify the precision displayed inside the measure label and X-Y coordinate display boxes, located in the upper right hand side of the Results Display window.

Measure Label Options

The Measure Label Options dialog shown in Figure 5-2 allows user to set the display item and features for the selected measure labels. All subsequent measures use the new settings specified in this dialog.

Figure 5-2 Measure Label Options dialog



Title Specifies the title string for the measure label.

X1 Specifies the title for the X1 value.

Y1 Specifies the title for the Y1 value.

Current X Specifies the title for the current X value (with label)

Current Y Specifies the title for the current Y value (with label)

Delta X Specifies the string in front of the Delta X value, for two point measurement.

Delta Y	Specifies the string in front of the Delta Y value, for two point measurement.
Slope	Specifies the string in front of the Slope value, for two point measurement.
Derivative	Specifies the string in front of the Derivative value.
Orientation	Specifies the orientation of the measure label relative to the measurement point: NW - ?, NL- ?, SL-?, SW-?.
Transparency	Specifies whether the background of the measure label is to be transparent or opaque.

Avant!

6

Creating Macros and Expressions

This chapter describes the procedures for building expressions and macros with the Expression Builder in AvanWaves. Simulation data from Star-Hspice can be analyzed in AvanWaves by displaying available raw output data. However, more complex analyses can be performed by combining the simulation data in mathematical expressions that include

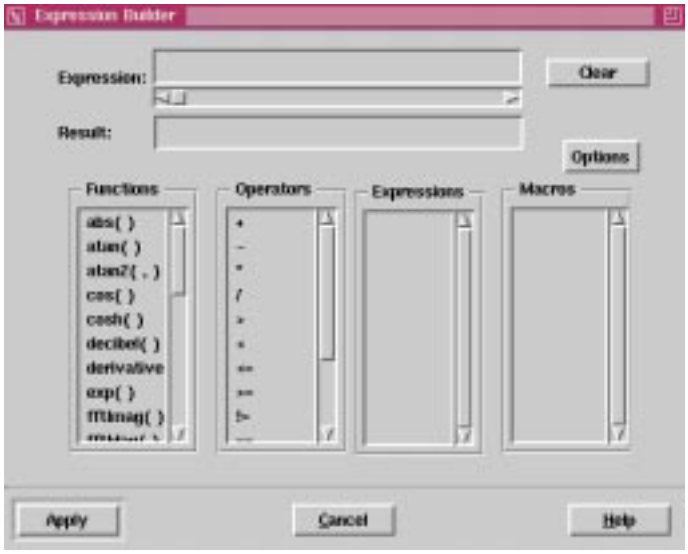
- Predefined functions
- Operators
- Other expressions
- Macros

How these components are combined to create expressions for analysis of simulation data is described in the following sections.

Using The Expression Builder

The Expression Builder, shown in Figure 6-1, is used to create expressions to perform detailed analysis of simulation data. The waveforms produced by the expressions can be displayed in the Results Display window.

Figure 6-1 Expression Builder window



Note: When bringing arguments into expressions, if they contain sweep data, the expression is calculated for each of the sweeps. However, the Expression Builder cannot deal with expressions that have different numbers of sweeps for each of its arguments – for example, five sweeps in arg1 and ten sweeps in arg2. The number of sweeps must be the same for all arguments in the expression.

Expressions can be created by typing the expression directly into the expression field, or they can be created by making selections in the desired order from the lists of available functions, waveforms, operators, macros, and other expressions.

Using Functions

The Functions list shows the functions that are available for use in creating expressions and macros. These are predefined functions. The functions available in AvanWaves are defined in Appendix B.

To use a function in an expression:

1. Select the function from the Functions list, then drag it into the Expression field. Alternatively, double-click on the function to insert it into the Expression field at the current cursor location. You can place the cursor by clicking at the desired insertion location.
2. Enter the arguments for the function either manually or by selecting and dragging curves from the Results Browser.

If a function takes two arguments, you can select both values for these arguments from the Results Browser and drag them to the Expression field together. Each curve entered as an argument is prefixed with its design and analysis number.

All functions work on either constants or waveforms. If a function is applied with one argument that is a constant and one argument that is a waveform, the constant is changed into a "constant value" waveform, and then the operation is performed.

Functions and Expressions can contain arguments that have not yet been defined. A function must have at least one argument, and not more than two. The expression name must be unique.

Using Operators

A set of arithmetic, numeric comparison, Boolean, and conditional operators are available for use in building expressions and macros in the Expression Builder. The following are the types of operators that can be selected from the Operators list:

- Arithmetic (+, -, *, /) — return analog waveforms only
- Comparison (>, <, <=, >=, !=, ==) — return logical waveform results (1 or 0)
- Boolean combination (&&, ||, !) — return logical waveform results (1 or 0)
- Conditional (expr1 ? expr2 : exp3) — analog wave built from expr2 if expr1=0 or expr3 if expr1 is not equal to 0

To use an operator in an expression:

1. Place the cursor in the expression where you want to enter the operator.

2. Select the operator from the Operators list.
3. Click on the operator and drag it into the Expression field.

Alternatively, double-click on an operator to insert it into the Expression field at the current cursor location.

Using Curves in Expressions

Any curve (simulation waveform) can be placed in an algebraic expression as a parameter. The result of the expression operating on the waveform then can be displayed as a new waveform.

To use a waveform as a parameter in an expression:

1. Select the function to use.

   In the Expression Builder window, double-click on the function you want to use in the expression. The function is displayed in the Expression field of the Expression Builder window.

2. Select the waveform.

   In the Results Browser, select the waveform you want to use. Holding the mouse button down, drag the waveform into the Expression field of the Expression Builder window. This places the waveform inside the function, so that it can be used as an argument.

Note: A function can have many parameters or arguments. You can select waveforms to be used as parameters in a function one at a time, or make multiple selections. When you insert multiple waveforms in the Expression field, they fill up the parameter values in the order in which you select them.

Selecting and Editing Expressions

To select an existing expression:

1. Click **Clear**. This clears the Expressions field.
2. With the left mouse button, double-click on the expression (result name) in the Expressions list.

The actual expression is displayed in the Expression field, and the name of the expression is displayed in the Result field.

To edit the definition of an expression:

1. Select the expression.
2. In the Expression field, modify the expression definition, then click **Apply**.

   The expression is modified to reflect the changes.

Another way of modifying an expression is by changing the macro definition within the expression. More information on Macros can be found in the “Editing a Macro” section on Page 6-6.

Using Expressions

The Expressions list contains all the expressions created in AvanWaves using the Expression Builder. The expressions are saved with the current designs when a configuration is created. An expression can be used as part of another expression by selecting it and dragging it into the Expression field.

To add an expression to the Expressions list:

1. Enter an expression in the Expression text entry field, and enter a name for the result in the Result field.
2. Click **Apply** or press **Return** to enter the expression in the Expressions list.

   The expression is entered in the list under the Result name.

To expand an expression to display its definition:

Double-click on the result name in the Expressions list.
The expression name is entered into the Result field and the expression definition is displayed in the Expression field.

To display an expression:

1. Select the expression name in the Expression list and drag it into the waveform display area of the panel.

   The result of the expression is displayed as a waveform, and the name of the expression, preceded by the design and analysis number, is added to the Wave List in the Results Display window.

You cannot display an expression whose result is simply a constant, for example, abc = abs(-20). You can use it in another expression, but cannot display a constant result such as 'abc' by itself. It must have a signal associated with it.

2. To view the waveforms associated with the expression, double-click on the name of the expression in the Wave List.

Note: Sweeps that are derived from an expression are not expanded in the Wave List, but they are expanded when they come from the simulator.

Deleting Expressions

To delete an expression from the Expression list:

- Using the left mouse button, select the expression from the list, then click **Delete**.

  or

- Select the expression, then select **Options** → **Delete Expression**.

Using the Macro Builder

Macros are user-defined expressions in a C-like language. The Macros list shows all of the macros created or loaded into AvanWaves. Macros can be selected from this list to be used in expressions in the same way that functions are used in expressions.

Components of a AvanWaves macro are as follows:

Macro Head	the name of the macro and the names of its arguments.
Macro Body	any combination of functions and operators available in the Functions and Operators lists in the Expression Builder window
Notes	notes about the macro

The head of a macro contains the macro name, followed by a parenthesized list of parameters separated by commas. For example the head of a magnitude function could be:

```
mag(x,y)
```

The body is the definition of the macro, which uses the parameters specified in the head. For example, the body of a square root function could be:

```
sqrt(x*x + y*y)
```

To use a macro in an expression:

1. Place the cursor in the expression where you want to enter the macro.
2. Select the macro using the left mouse button.
3. Click on the macro with the middle mouse button, and drag and drop it into the expression field.

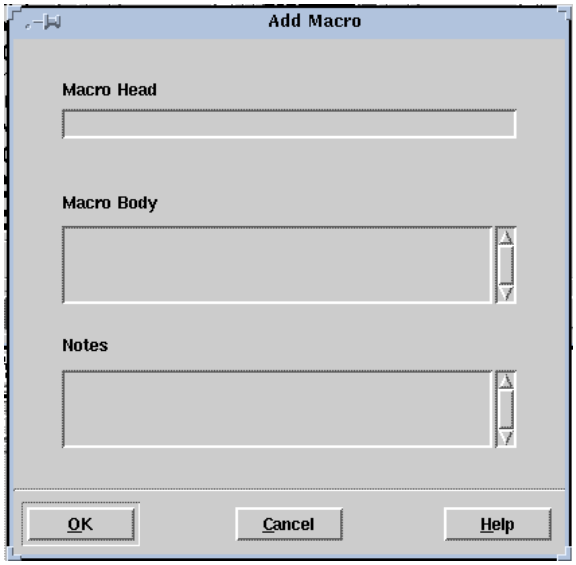
   Alternatively, you can select the macro and double-click on it with the left mouse button.

Creating and Using Macros

To create a macro:

1. Select **Options** → **Add Macro** in the Expression Builder. This displays the Add Macro dialog box, as shown in Figure 6-2.
2. Enter the name of the macro and the arguments associated with the macro into the Macro Head field.
3. Enter the macro definition into the Macro Body field. The macro definition can contain functions and operators defined previously in the Expression Builder window.
4. Click **Apply** to add the macro to the Macros list.

Figure 6-2 The Add/Edit Macro dialog



To use a function or operator in a macro definition:

1. Place the cursor at the point in the macro where you want to enter the function or operator.
2. Select the function or operator with the left mouse button.
3. Click on the function or operator with the middle mouse button, and drag and drop it into the macro body.

To use an operator in a macro definition:

1. Place the cursor at the point in the macro where you want to enter the operator.
2. Select the operator with the left mouse button.
3. Click on the operator with the middle mouse button, and drag and drop it into the macro body.

Displaying a Macro

To display a macro that has previously been defined:

1. Select the macro from the Macros list.
2. Select **Options** → **Edit Macro**.

   The Macro head, definition, and any notes on the macro in the Edit Macro dialog are displayed.

Editing a Macro

To edit a macro:

1. Click on the macro you want to edit in the Macros list.
2. Select **Options** → **Edit Macro**.
   This displays the Edit Macro dialog box containing the macro you selected.
3. Enter your changes to the macro head, body, or notes sections.
4. Click **OK** to apply the changes you made.

The updated Macro is added back to the Macros list.

To update an expression after editing a macro:

1. In the Expression Builder, select each expression that uses the macro.
2. Click **Apply**.

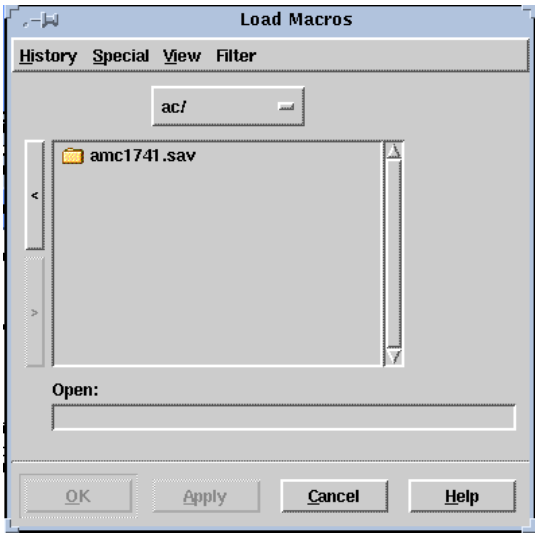
This updates the expressions to use the new macro definition.

Loading a Macro

The Load Macros function is used to load previously-saved macros into the Macros list. Macros are user-defined functions and can be used in building expressions.

*Note: The Load Macros dialog by default lists the available macro files with names of the form *.mac. Use the Filter command to display other types of files.*

Figure 6-3 The Load/Save Macro Dialog



To load a macro:

1. Select the directory location of the macro and select the name of the saved macro file.
2. Click **OK** or **Apply** to load the selected macro file and add it to the Macros list in the Expression Builder window.

Saving a Macro

The Save Macro window allows you to save macros created during the current session to a file. This allows you to load and use them in another AvanWaves session with other designs.

To save a macro:

1. In the Save Macro dialog, select the directory and the name of the file in which to save the macro.
2. Click **OK** or **Apply** to save the macro definition to the selected file.

Deleting a Macro

To delete a macro, choose one from the Macros list and select **Options → Delete Macro**.

Avant!

7

Using Configurations

A configuration in AvanWaves is a snapshot of the AvanWaves environment. You can create and save a configuration, or a set of configurations, for any design. You can open a saved configuration later in the same AvanWaves session or in future AvanWaves sessions.

The following information is saved in a configuration file:

- status of all tools, windows, measurements, and notes
- all panels and waveform displays
- expressions and macros
- interactive measurement data
- labels

Configuration Files

Configurations are stored in configuration files with names of the form <*config_name*>*.cfg* in the directory <*design*>*.sav* in your design directory. Use the **Configuration** → **Save** command to name the file in which to save the configuration. You can use the **Configuration** → **Open** command to load the configuration back into AvanWaves.

You must open a design (with the **Design** → **Open** command) before you can use any of the Configuration menu commands.

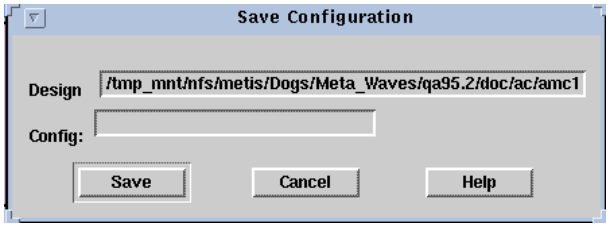
Saving a Configuration

To save a configuration:

1. Select the **Configuration** → **Save** command in the Results Display window.

   The Save Configuration dialog appears. The complete path to the current design is shown in the Design field. The Save Configuration dialog allows you to save the configurations during a AvanWaves session. This is helpful for documenting your circuit simulation, or for restoring a configuration in a later AvanWaves session. Only data derived during your present session is stored.

Figure 7-1 Save Configuration dialog



2. In the Config field, enter the name of the file in which you want to save the current configuration.
3. Click **Save** to save the configuration.

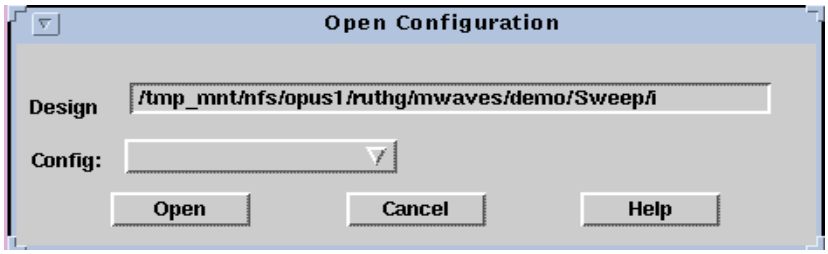
   If a configuration file with the same name already exists in the <*design*>.*sav* directory, you will be asked to confirm that you want to overwrite it.
4. Click **OK** to overwrite the configuration, or **Cancel** to cancel the current operation.

Opening a Configuration

To open a saved configuration:

Select the **Configuration** → **Open** command in the Results Display window.
The Open Configuration dialog is displayed.

Figure 7-2 Open Configuration Dialog



The complete path to the current design is shown in the Design field. The name of the first configuration that was opened for the current design is displayed in the Config field. Before opening a new configuration you are prompted to save the state of your current design.

To see a list of all configurations for the current design:

1. Select the pull-down arrow in the Config field with the left mouse button.

   The pull-down menu is displayed.

2. Select the configuration that you want from the menu, then click **Open**.

   The new configuration is opened.

Opening a configuration removes all o f the information on the screen about the current design and replaces it with the design information associated with the selected configuration. The state of the panels and the tools is set to the state of the configuration just opened.

If the configuration you opened belongs to the current design, but also contains waveforms from another design, the associated design is opened and displayed. Another window also is opened, listing the waveforms that were not retrieved in opening the configuration, giving the design name, and giving you the option to open the design. To open the design, click **Apply** in this window. The design is then opened and the panels updated with the waveforms.

Note: You can only see the configurations associated with the current design.

Deleting a Configuration

To delete a configuration:

1. Select the **Configuration** → **Delete** command in the Results Display window.

   This displays the Delete Configuration dialog box. The path to the currently open design is listed in the Design field.

2. To select the configuration you want to delete, click on the pull-down arrow in the Config field.
3. Select the configuration to delete.
4. Click on **Delete.**

Avant!

8

Setting Preferences

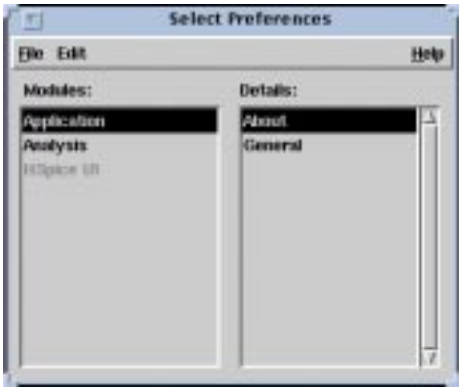
This chapter describes the procedures for customizing your environment and setting personal preferences in MetaWaves. You can set

- General application preferences
- Preferences for displaying and analyzing waveforms, such as waveform color and symbol type

The Select Preferences Window

Open the Select Preferences window by selecting **Tools** → **Preferences** in the Results Display window. The Select Preferences window contains a set of menu options that provide general information on the MetaWaves application. (See Figure 8-1.) Select options on the menu or click on the lists in the dialog box to set your general application preferences.

Figure 8-1 Select Preferences window



Menu Options

The menu options available in the Select Preferences window are

File → Close Window	Closes the Select Preferences window.
Edit → Selected	Not available in this release.
Edit → Application → About	Displays the “About” box for the MetaWaves application, giving version and copyright information.
Edit → Application → General	Displays a dialog box for setting general application preferences for font, foreground, and background colors.
Edit → Analysis → Curves	Allows you to set color preferences and continuity for displaying waveforms, the symbol type, and selecting frequency for displaying data points on waveforms.

Setting Analysis Preferences

The Set Analysis Preferences window is used to select the following waveform attributes:

- The color of the displayed waveform
- Whether the continuity symbol is displayed
- The symbol used to represent the displayed data points on a waveform
- The frequency with which the symbols are placed on a waveform

This dialog sets the defaults for the eight curve preferences inherited in each panel. The preferences for each curve are set individually.

To bring up the Set Analysis Preferences window, in the Select Preferences window select **Edit** → **Analysis** → **Curves**.

Setting the Waveform Color

A default set of colors is available initially for displaying the curves. You can change the colors in the set and the order in which they are used.

To customize the color of a waveform:

1. Click in the color box associated with a particular curve.
   The Color Preference Chooser is displayed.
2. In the circular color palette, select the color in which you want to display the curve.

   The selected color is displayed in a view box beside the palette. Three color control boxes (Light, Hue, and Saturation) are displayed below the palette.
3. Click inside these boxes to select the amounts of light, hue, and saturation that you want to make up the new color.
   The arrows move to indicate your new Color, Hue, and Saturation selections.
4. Repeat these steps for each curve for which you want to change the display color.
5. To apply the color to the currently selected curve, click **OK**.

The dialog box disappears and the color box in the Set Analysis Preferences window is updated.

Setting Continuity Display

Select Continuity to display connections between the data points of a waveform. Setting Continuity off displays only the symbols representing the data points, with no curve segments connecting the symbols. The default value is on. A single click toggles the feature on or off.

Setting the Line Style

You can assign different line styles to each curve to differentiate waveforms on monochrome hardcopy plots. Default line styles are automatically assigned to the basic set of eight curves.

To change the line style assigned to a curve:

1. Click on the line style that you want to change.
   The Line Style Chooser is displayed for the particular curve associated with that line style.
2. Select a line style from one of the eight line styles available for each curve.
3. Click **Apply**.

Setting the Symbol Type

You can assign different symbols to each curve to differentiate waveforms on monochrome hardcopy plots. The symbols used to represent the data points on a curve are selected with Symbol function. Only one symbol can be used per curve. Default symbols are automatically assigned to the basic set of eight curves.

To change the symbol assigned to a curve:

1. Click on the symbol that you want to change. The Symbol Chooser is displayed for the particular curve associated with that symbol.
2. Select a symbol from one of the nine symbols available for each curve.

3. Click **Apply.**

Setting the Symbol Frequency

The Frequency setting determines how many of the available data points on a waveform are marked with the designated symbol. For example, a symbol frequency of 2 displays the symbol for alternate data point. A frequency of 0 means that only the first data point on the curve is marked with the symbol. Click **OK** to apply the preference selections.

Setting General Preferences

The Set General Preferences dialog lets you set preferences for foreground and background colors and to set the font used for menu and window names and for displaying messages.

To bring up the Set General Preferences window, in the Select Preferences window select **Edit** → **Application** → **General**.

Setting the Font

The Font Preference Chooser allows you to customize the font used in the MetaWaves application.

To customize the font:

1. Click **Set Font** to open the Font Preference Chooser.
2. In the Family box, select the font you want to use.

   The selected font is displayed in a view box at the top of the Font Preference Chooser dialog box.
3. In the Face box, select the typeface that you want to use.
4. In the Size box, select the font size

   The fonts available depend on your current windowing system.
5. Click **OK**.

Setting Background and Foreground Colors

Use the Color Preference Chooser to customize the foreground and background colors for your application.

To set background or foreground colors in the MetaWaves interface:

1. To open the Color Preference Chooser, click **Set Background** or **Set Foreground**.
2. In the circular color palette, select the color you want by clicking on that colored area.

   The selected color is displayed in a view box beside the palette. Three color control boxes (Light, Hue, and Saturation) are displayed below the palette.
3. To select the amounts of light, hue, and saturation that you want to make up a particular color, click inside these boxes.
   The arrows move to indicate your Color, Hue, and Saturation selections.
4. To apply the color to the foreground or background, click **OK**.

   The dialog box disappears and the colors are updated.

Avant!

9

Using the Run Manager

The AvanWaves Run Manager provides a way to start and stop Star-Hspice, edit the source files, and view the listing files for all of the open designs within the session. The status of the simulation run also is echoed to the screen for reference.

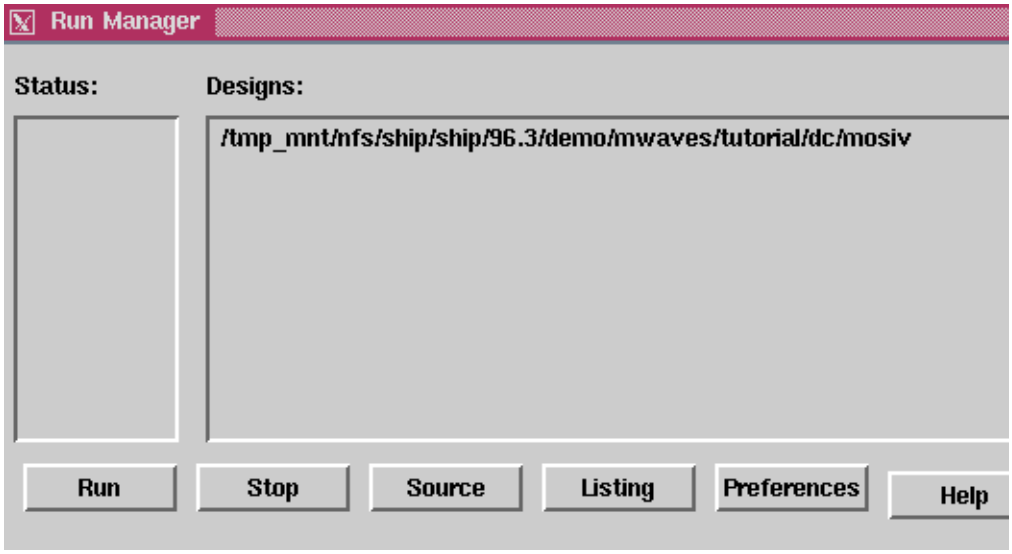
Invoking the Run Manager

To invoke the Run Manager from AvanWaves, select

Tools → Run Star-Hspice

This command brings up the Run Manager dialog box listing all open designs in the Designs listbox and the Status of each, as shown in Figure 9-1.

Figure 9-1 Run Manager dialog



Note: Although thissection uses Star-Hspice as an example, you can easily substitute it with Star-Sim by changing the value in the Default Simulator field under the ***Preferences*** *button.*

The features of the Run Manager dialog are

Status Lists the present status of each Star-Hspice job.

Design Lists all open designs. You can run a design, edit a source file, and view a listing in simultaneous windows.

Run Displays the server chooser dialog for you to run Star-Hspice.

Stop Stops the Star-Hspice run.

Source Displays a window with the editor of your choice to edit the Star-Hspice source file (*.sp* file).

Listing Displays a window with the editor of your choice to view the Star-Hspice listing file (*.lis* file).

Preferences
Displays the Run Manager Preferences dialog, allowing you to select the type of text editor, simulator, and terminal to use.

Running Star-Hspice

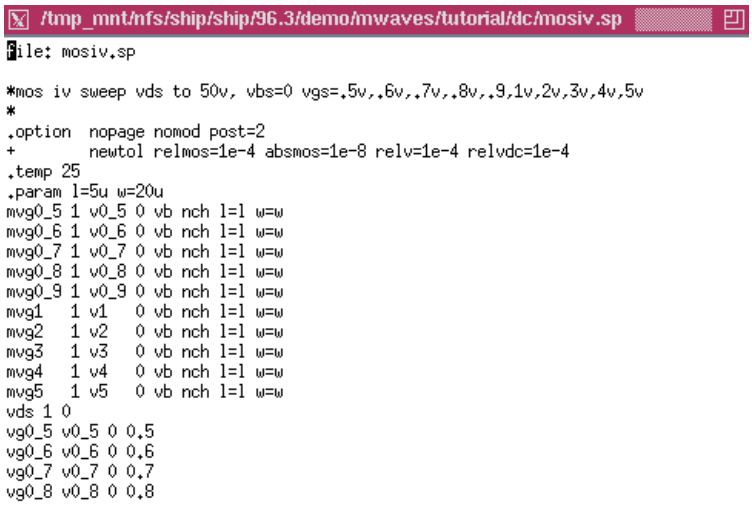
To run Star-Hspice from the Run Manager:

1. Select a design to run from the Designs listbox.
2. Click on the **Run** button. Star-Hspice is run on the design that you just selected.
3. Select **Panel** → **Update** to update the waveform display with the new simulation data.

Editing the Star-Hspice Source File

To edit the Star-Hspice input file (*.sp* file), click on the **Source** button in the Run Manager dialog, displayed in Figure 9-2. The source code is shown in the window with the selected text editor.

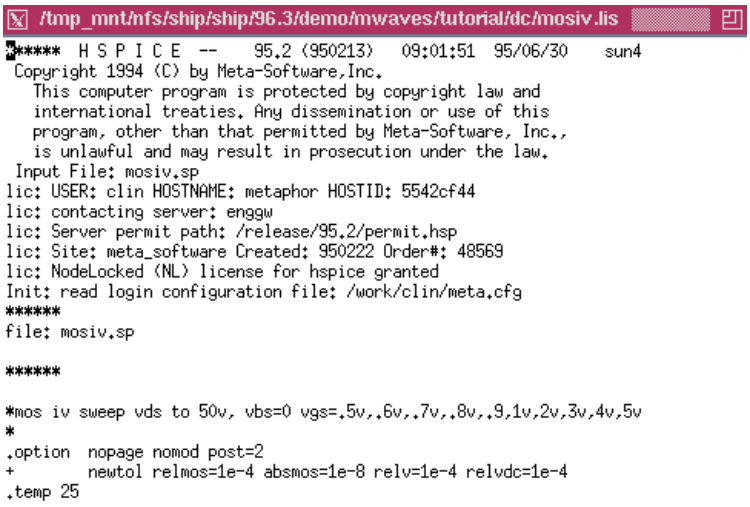
Figure 9-2 Star-Hspice source in VI editor window


/tmp_mnt/nfs/ship/ship/96.3/demo/mwaves/tutorial/dc/mosiv.sp
file: mosiv.sp
*mos iv sweep vds to 50v, vbs=0 vgs=.5v,.6v,.7v,.8v,.9,1v,2v,3v,4v,5v
*
.option nopage nomod post=2
+ newtol relmos=1e-4 absmos=1e-8 relv=1e-4 relvdc=1e-4
.temp 25
.param l=5u w=20u
mvg0_5 1 v0_5 0 vb nch l=l w=w
mvg0_6 1 v0_6 0 vb nch l=l w=w
mvg0_7 1 v0_7 0 vb nch l=l w=w
mvg0_8 1 v0_8 0 vb nch l=l w=w
mvg0_9 1 v0_9 0 vb nch l=l w=w
mvg1 1 v1 0 vb nch l=l w=w
mvg2 1 v2 0 vb nch l=l w=w
mvg3 1 v3 0 vb nch l=l w=w
mvg4 1 v4 0 vb nch l=l w=w
mvg5 1 v5 0 vb nch l=l w=w
vds 1 0
vg0_5 v0_5 0 0.5
vg0_6 v0_6 0 0.6
vg0_7 v0_7 0 0.7
vg0_8 v0_8 0 0.8

Viewing the Listing File

After a simulation is completed, you can view the listing file (*.lis*) by clicking the Listing button in the Run Manager dialog. The listing file is shown in the window with the editor of your choice, as shown in Figure 9-3.

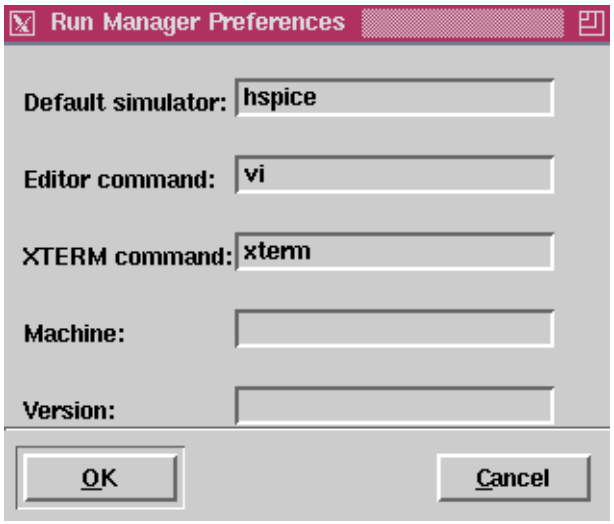
Figure 9-3 Star-Hspice Listing file in VI editor window


/tmp_mnt/nfs/ship/ship/96.3/demo/mwaves/tutorial/dc/mosiv.lis
***** H S P I C E -- 95.2 (950213) 09:01:51 95/06/30 sun4
Copyright 1994 (C) by Meta-Software,Inc.
This computer program is protected by copyright law and
international treaties. Any dissemination or use of this
program, other than that permitted by Meta-Software, Inc.,
is unlawful and may result in prosecution under the law.
Input File: mosiv.sp
lic: USER: clin HOSTNAME: metaphor HOSTID: 5542cf44
lic: contacting server: enggw
lic: Server permit path: /release/95.2/permit.hsp
lic: Site: meta_software Created: 950222 Order#: 48569
lic: NodeLocked (NL) license for hspice granted
Init: read login configuration file: /work/clin/meta.cfg
******
file: mosiv.sp
******
*mos iv sweep vds to 50v, vbs=0 vgs=.5v,.6v,.7v,.8v,.9,1v,2v,3v,4v,5v
*
.option nopage nomod post=2
+ newtol relmos=1e-4 absmos=1e-8 relv=1e-4 relvdc=1e-4
.temp 25

Run Manager Preferences

You can customize the Star-Hspice run environment, such as set the default simulator, the editor command, and the X-term command for Run Manager. To bring up the preference dialog, click on the **Preferences** button on Run Manager dialog, as shown in Figure 9-4 .

Figure 9-4 Run Manager Preferences dialog



Details of the field entries in the Run Manager Preferences dialog window are discussed below.

Default simulator	Usually Star-Hspice. Star-Sim is an alternative.
Editor command	Common options are vi or emacs. If your editor displays it own window, leave no entry in the XTERM command field.
XTERM command	Enter xterm in this field.
Machine	Enter the machine identification in this field .
Version	Enter the path to the install directory for the simulator that you want to run.

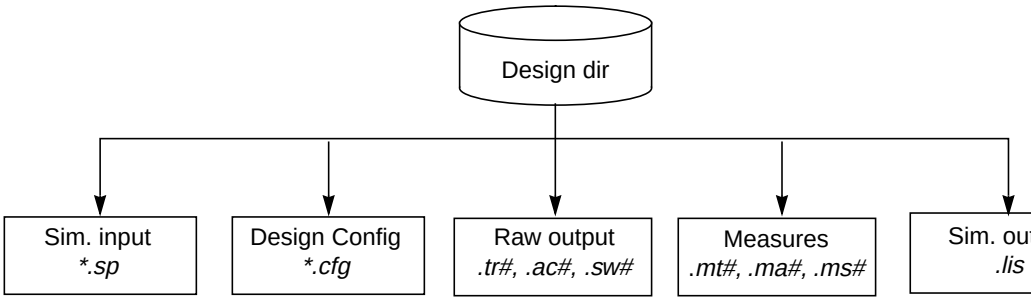
Avant!

10

Using the MS Windows Launcher

This chapter describes how to set up and use the MS Windows Launcher. The directory structure for the MS Windows Launcher is shown in Figure 10-1.

Figure 10-1 Directory Structure



Setting Up Required Files

The Launcher requires two files for successful operation:

%AVANHOME%\versions.txt

%AVANHOME%\hspui.cfg

The first of these files tells the Launcher what versions of Star-Hspice/Win are available for simulation and waveform analysis. The default file contents are:

<your AVANHOME> Star-Hspice/Win 1997.3

as in:

C:\AVANTI\97 *Star-Hspice/Win 1997.3*

The second of these files configures the Launcher with information from the last run.

Working with Designs

A new design can be created in several ways. The Launcher allows you to browse for an input file for Star-Hspice, which has the default file suffix *.sp*. The Launcher Browse button opens a standard file browser.

Selecting a file of the type <*design*>*.sp* causes the Launcher to display the main form, which contains the

- Input filename
- Design title (the first line of the file <*design*>*.sp*)
- Output filename
- Star-Hspice and AvanWaves version

New designs can be saved with the command **File** → **Save.**

The Design commands available in the Launcher are listed below:

File → **New**	Clears the Launcher and opens a new design
File → **Open**	Opens an existing design with the file browser
File → **Save**	Saves the current design information
File → **Save As**	(Not implemented in Version 1.0)
File → **Close**	Closes the current design
<LastDesigns>	A list of the last five designs opened
File → **Exit**	Exits the Launcher

The commands **File** → **New**, **Open,** and **Close** prompt the user to save the current design if changes have occurred.

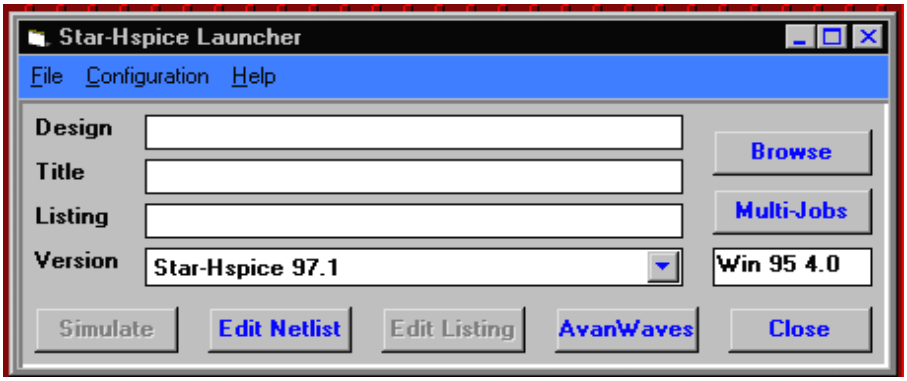
The Launcher checks on the status of a given design when it is opened. If the input file exists, the **Simulate** button is active. If the

listing file exists for the design, the **Edit Listing** button is active. The **Edit Netlist** and **AvanWaves** buttons are always active.

It is not necessary to save a design in order to Simulate or view the results of a simulation with AvanWaves.

Figure 10-2 shows the main window of the Launcher.

Figure 10-2 Launcher Main Window



Configuring the MS Windows Launcher

Customize configurations using the Configuration menu of the Launcher as shown in Figure 10-3.

The start-up directory defaults to the value of the *AVANHOME* environment variable set up during Star-Hspice installation.

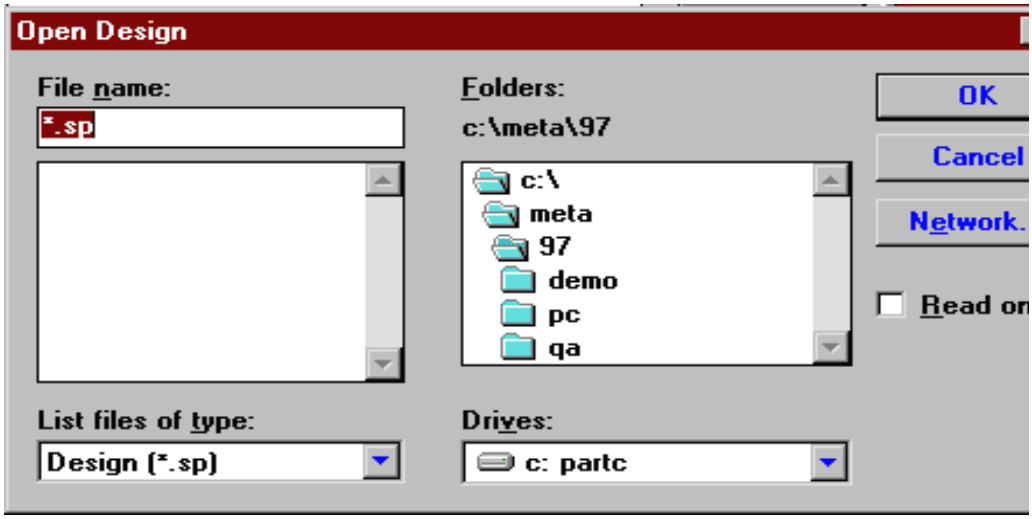
The input file suffix defaults to *.sp*.

The output file suffix defaults to *.lis*.

The editor defaults to *notepad.exe*.

Changing any of these values causes the Launcher to update the file *<AVANHOME>/hspui.cfg* with the new values. The next run of the Launcher provides the new values.

Figure 10-3 Launcher Options Window



The menu item **Configuration** → **Versions** displays the current executables and their paths for the Launcher (HSPUI), Star-Hspice, and AvanWaves.

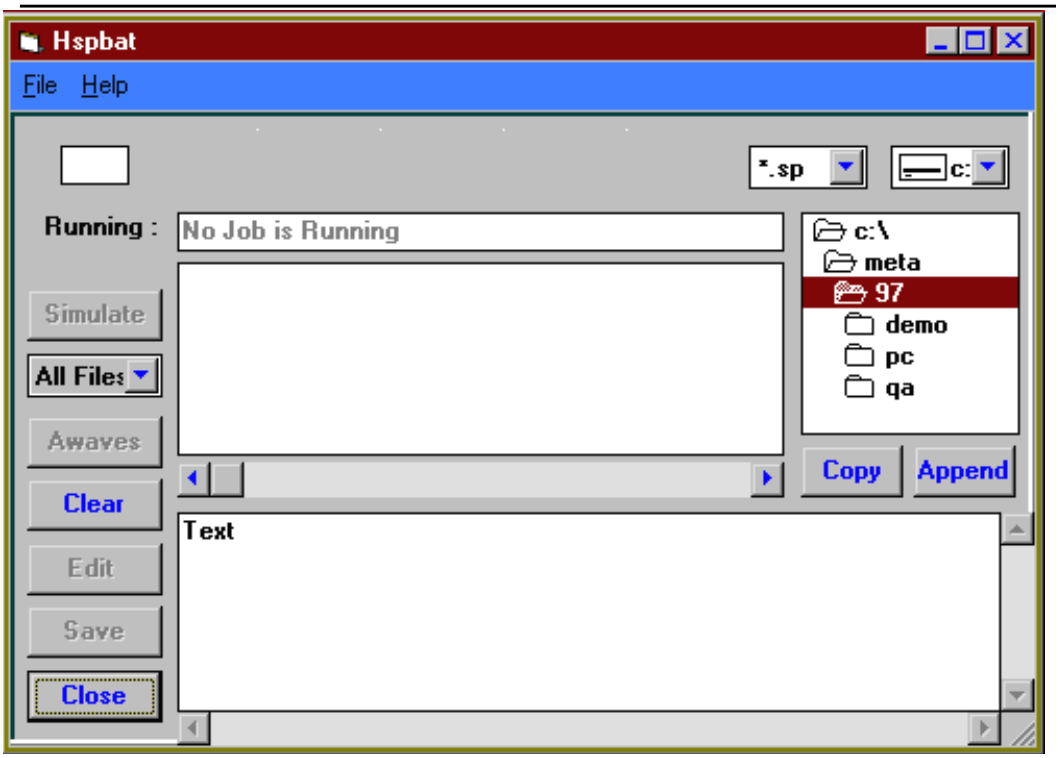
Note: Standard menu items, such as File and Edit, although displayed on the Star-Hspice/Win menu bar, are not available to use in this release.
*The **Configuration** → **Version** strings are changed from the main window Versions combo box. You cannot change them here.*
*You can associate your <design>.sp file with the Launcher using the **File** → **Associate** command in the Windows File Manager. This allows you to double-click on an .sp file in the File Manager window and automatically invoke the Star-Hspice/Win Launcher.*
Please refer to your Windows documentation for details on how to do this.

Running Multiple Jobs

Use the Star-Hspice/Launcher file browser to build a list of simulations from different directories for consecutive Star-Hspice processing.

Pressing the **Multi-Jobs** button in the main window opens the Star-Hspice Multi-Job window (see Figure 10-4). Simulation files are chosen from the Drive/Directory list box and placed in the Files list box.

Figure 10-4 The Star-Hspice Multi-Jobs Window



Building the Batch Job List

1. Press the **Multi-Jobs** button in the main window.
2. Using the Drive/Directory boxes, locate the directory of files that you wish to simulate.

3. To copy all files in the directory, press the **Copy** button on the right side of the Hspbat window.
   Note that any file names already in the list will be replaced.
4. To add additional files from other directories, repeat Step 2 and use the Append button.

Simulating the Batch Job List

1. To simulate all of the files in the Batch Job list, set the pulldown menu to **All** and press the **Simulate** button.
2. To run simulation on a single file or a group of files, set the pulldown menu to **Selected** and select those files you wish to simulate from the Batch Job list box.

   Use the left mouse button to select a single file.

   Press and hold the **Control** key and select another file with the left mouse button to add to the selected list.

   Press and hold the **Shift** key to select all files between the current file and the last selected file.
3. Press the **Simulate** button to start the consecutive simulations.

Using the Drag and Drop Functions

The Star-Hspice Multi-Jobs window provides a drag and drop capability to remove files from the list, edit files, run simulations and view the results with AvanWaves.

Beside the icons, the user also can use the Text Editor box to view and edit the design file (<*design*>.*sp*). To do this, drag and drop the file from the upper list box to the bottom one. The file contents are displayed in the bottom editor for the user to view and/or edit.

To display the files associated with a design, double click on the upper list box on the selected design file (<*design*>.*sp* file). All the associated files (tr#, ac#, sw#, mt# ...) are listed in the bottom list box.

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11

Running the Tutorial

The examples within this chapter describe how you can use AvanWaves to evaluate the results of various types of Star-Hspice simulations. This chapter contains examples for three kinds of analysis:

- AC
- Transient
- Fast Fourier Transform (FFT)

The example files are included with the product distribution. Working with these examples will demonstrate how to use AvanWaves to

- Create a Bode plot using the AC analysis results obtained from Star-Hspice.
- Review the results of an Star-Hspice transient simulation with FFT analysis.

Table 11-1 lists the example file for each type of analysis and its location.

Table 11-1 Example Files

Analysis	Directory	File Name
TRANS and FFT	*$installdir/demo/awaves/tutorial/tran*	*cpath.sp*
AC	*$installdir/demo/awaves/tutorial/ac*	*amc1741.sp*

Invoking AvanWaves

Run AvanWaves by typing this command on the command line:

```
awaves
```

The About AvanWaves window displays on the screen, followed by the Results Display window. This is the main application window, which contains all the menu options and tools used in AvanWaves. It also is the main display window for viewing waveforms.

AvanWaves also can be run with a number of options on the command line allowing you to specify the design that you want to use before you enter the application. In this case AvanWaves is loaded with the design and the environment is set up for that particular design. Additional setup information is provided in Chapter 2, “Getting Started.”

Transient and FFT Analysis

This example demonstrates how AvanWaves is used to evaluate the results of an Star-Hspice transient simulation with FFT analysis. The design *cpath.sp*, in the $*installdir/awaves/tutorial/tran/* directory, is used in this example.

Opening the Design

To open the design *cpath.sp*:

1. In the Results Display window, select **Design** → **Open**.
   The Open Design window is displayed.
2. In the Open text area, enter the following design file path name:

```
$installdir/demo/awaves/tutorial/tran/cpath.sp
```

3. Click **OK**.

The Results Browser is displayed, listing all of the analysis files associated with this design.

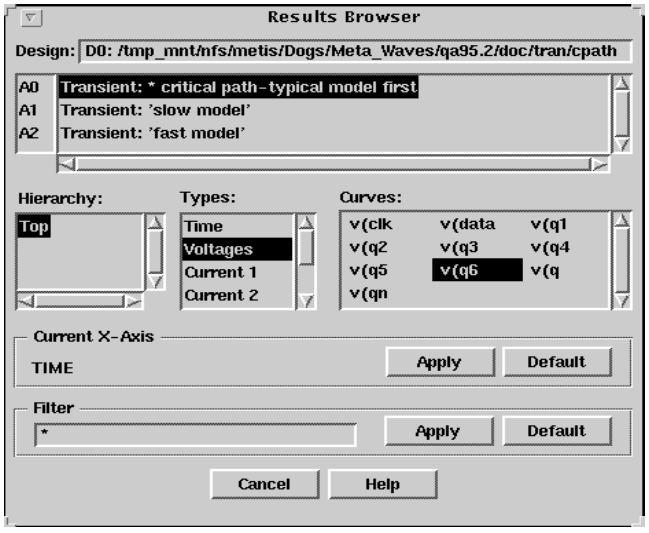
Selecting the Analysis File

The Results Browser displays the different analyses associated with the design. Three analysis files are available:

- A0 — typical model
- A1 — slow model
- A2 — fast model

To display a waveform, you must select an analysis file and an analysis type. You can then display an output waveform associated with that analysis in a panel by selecting it in the Results Browser, as shown in Figure 11-1.

Figure 11-1 The Result Browser Showing v(q6 Selected for A0



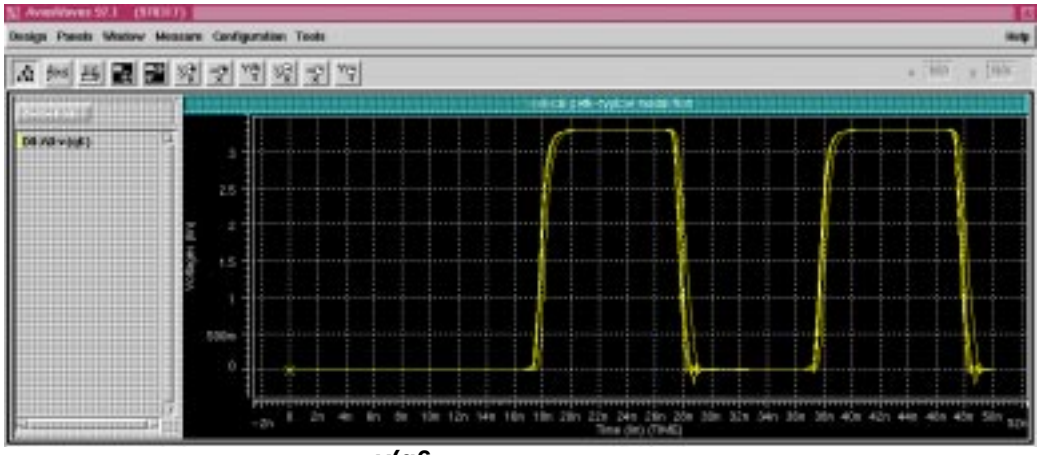
To display a curve:

1. In the Results Browser, select the typical model, **A0**.
2. In the Types section, select **Voltages** as the analysis type.

   This displays a list of all the curves associated with that type in the Curves area.
3. In the Curves section of the Results Browser, select the curve **v(q6**, then drag it into the Panel in the Results Display window.

   The voltage output is displayed versus time for five different inverter sizes.

Figure 11-2 The Results Display window showing sweeps for v(q6

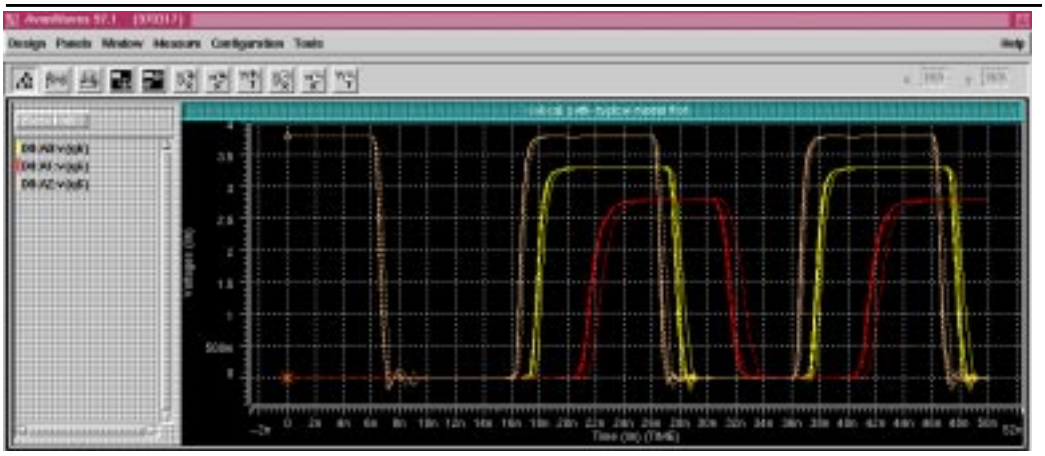


To select and display the curve v(q6 for analyses A1 and A2:

1. In the Results Browser, select the model **A1**. The curves are listed for this analysis.
2. In the Types section, select **Voltages** as the analysis type.
3. Select the curve **v(q6**, then drag it into the results display area.

Select the model **A2**, and do the same for it using the curve **v(q6**. One waveform for each analysis is now displayed in the Results Display window, as shown in Figure 11-3.

Figure 11-3 Voltage v(q6 displayed for A0, A1, and A2



Sweep Filtering

Sweeps can be selected in a number of ways for highlighting, displaying, or deleting.

To highlight a specific sweep among a set of sweeps:

1. Double-click on the waveform name associated with that sweep in the Wave List.

   The name expands to show all of the sweeps associated with the waveform.

2. Double-click on the sweep in the Wave List.

   The specific sweep curve is highlighted in the Results Display area.

You can select the sweeps that you want displayed in the panel using the Sweep Filter. To display the sweep S0 for each of the three analyses, do the following:

- In the context-sensitive menu associated with the waveform display area, select **Sweep Filter**.

  The Sweep Filter dialog box is displayed, containing a list of all the sweeps associated with the waveforms. The sweeps are listed by analysis. You can show and hide sweeps in the panels by making selections in the Sweep Filter.

To display the S0 sweeps on each of the three analyses, with size=1:

1. In the Sweep Filter, select all the zeros in the first column of the dialog box, as shown in Figure 11-4.
2. Click **OK** or **Apply**.

   The three S0 sweeps are displayed in the panel in the Results Display window, shown in Figure 11-5.

Figure 11-4 The Sweep Filter with the S0 sweeps selected

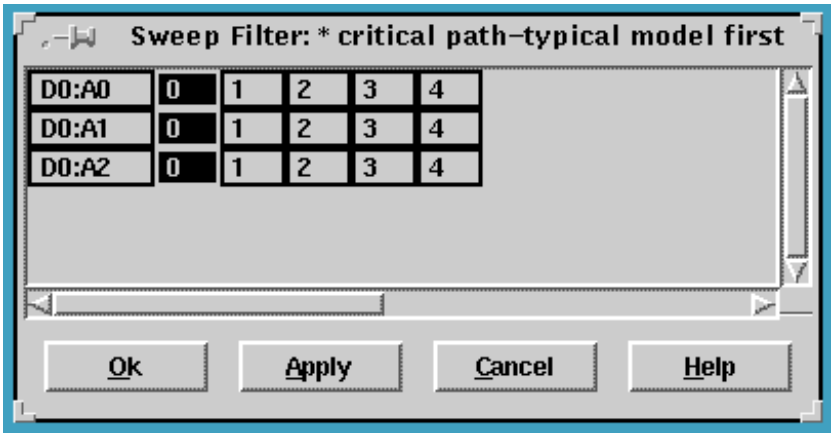
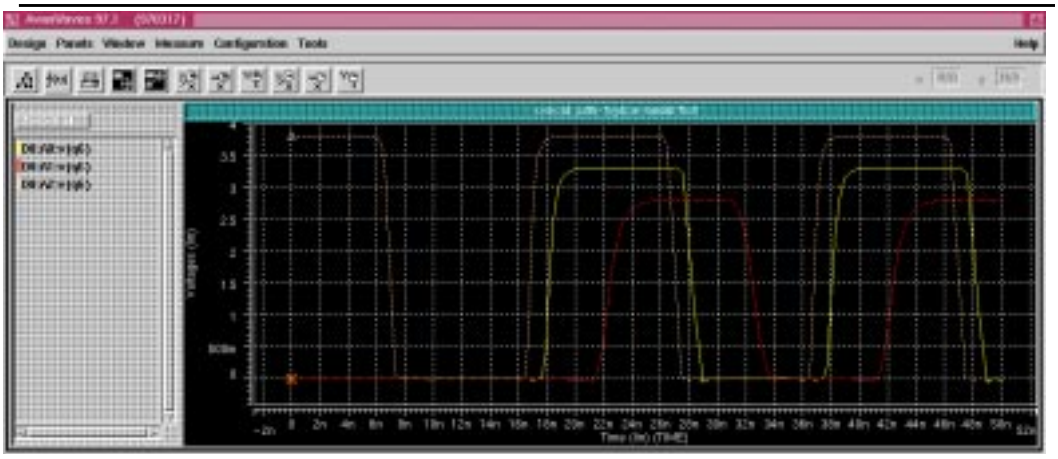


Figure 11-5 S0 displayed for analyses A0, A1, and A2



Using the Zoom In X Feature

To zoom into the area that you want to measure along the X-axis:

1. In the context sensitive pop-up menu, select **Zoom** → **Zoom In X.**
2. Select the area on the X-axis from time=15 to time=25.
   The view in the panel changes from the full view of the design to the view that you selected.

Note: To avoid the measure labels overwriting each other on the screen, it is recommended that you zoom into the area that you want to measure before you select the Measure option.

Using Measures

The difference in output delay between the three models can be calculated using the Measure option.

To measure the delay between A2 and A0 (the typical and the fast models):

1. In the context-sensitive menu for the panel, select **Measure** → **Preferences All Values**, then select **Lock in X** from the same menu.
   This allows you to measure along the X-axis only.
2. Select **Measure** → **PointToPoint** from the main menu.
   A cursor appears on the screen that is used to measure between points. This cursor snaps to the closest waveform.
3. Click **A2**, the fast model, where Voltages = 2 and Time =16.9 ns, to place the first marker on this waveform.
4. Click **A0**, the typical model curve, to place the second marker on that curve.
   The delta and slope values are displayed for the two points on A2 and A0.

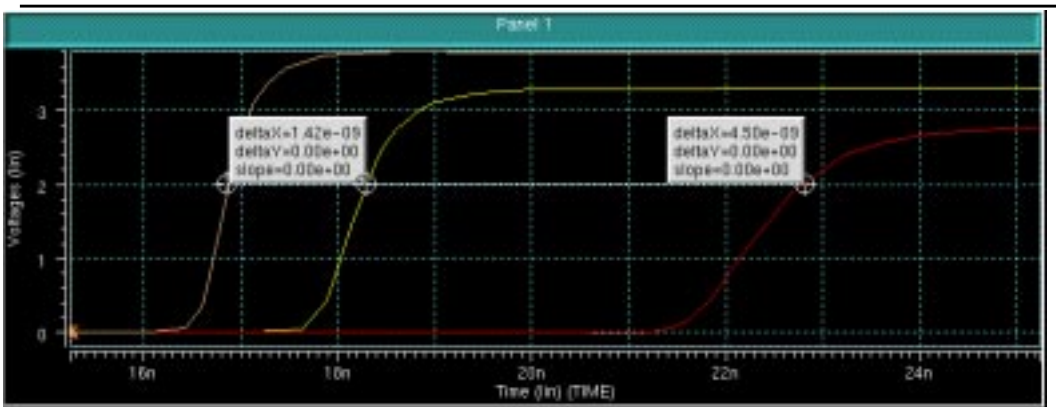
To measure the delay between A0 and A1 (the typical and the slow models):

1. Select **Measure** → **PointToPoint** from the main menu.

2. Click **A0**, the typical model curve, where Voltages = 2 and Time = 18.2ns, to place the first measure point on this waveform. The marker snaps to the waveform.
3. Click **A1**, the slow model, to place the second measure point on this waveform.

   The delta and slope values are displayed for the two points on A0 and A1.

Figure 11-6 Diagram displaying the Measure labels



Now you have obtained the differences in delay between the fast model and typical model and the typical model and the slow model.

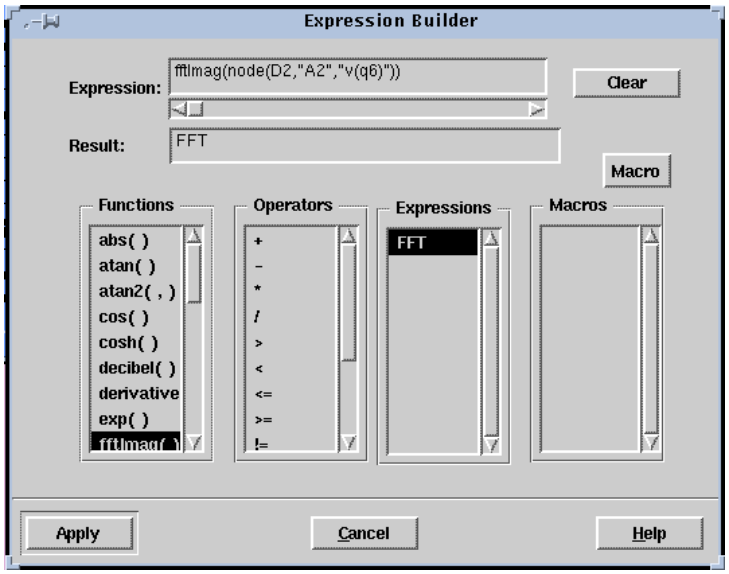
FFT Analysis

To display the frequency response of one of the elements based upon the FFT analysis, do the following:

1. To add a new panel to the display area, double-click **Add Panel** in the Panel List.
2. To display the Expression Builder, click the Expression Builder icon on the Accelerator menu or select **Tools** → **Expressions**.
3. In the Expression Builder, double-click on **fftMag()** in the Functions list to select it and add it to the Expression definition field.
4. In the Results Browser, select the curve **v(q6** and drag it to the Expression definition field of the Expression Builder.

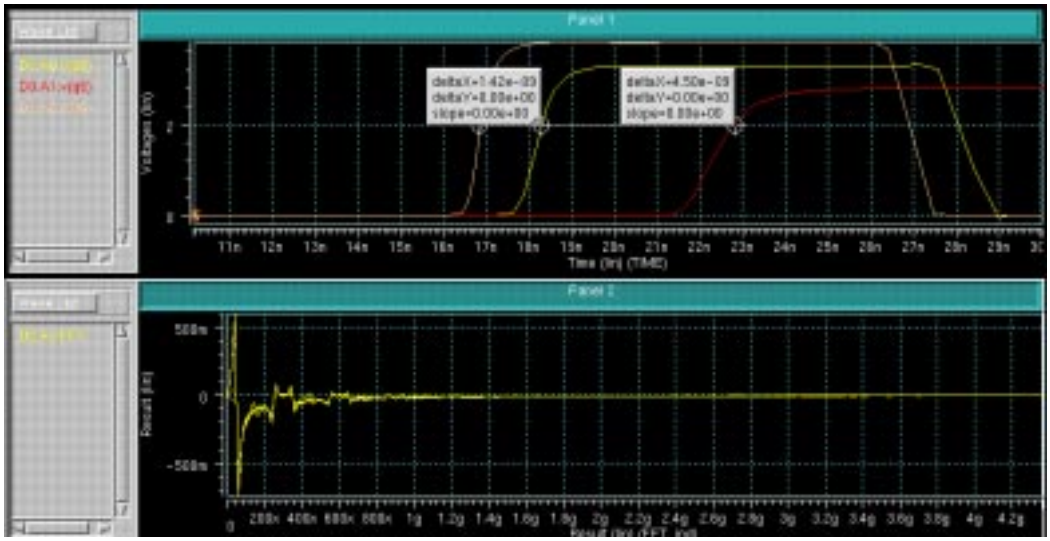
5. Assign a name to the new expression – for example, FFT.
6. To add the new expression to the list of expressions, select **Apply**.
7. Select the expression in the Expression list and drag it into the new panel in the Results Display window.

Figure 11-7 The Expression Builder showing the selected FFT expression



Both time and frequency domain outputs are now displayed in the Results Display window for the chosen element, as shown in Figure 11-8.

Figure 11-8 Time and frequency response from FFT simulation

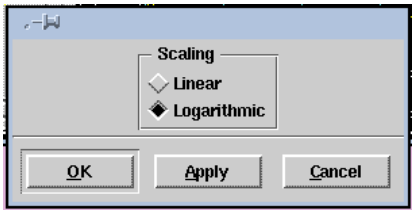


Changing Display Parameters

Different scaling and viewing options are available in AvanWaves, such as linear, logarithmic, and zooming, as described below.

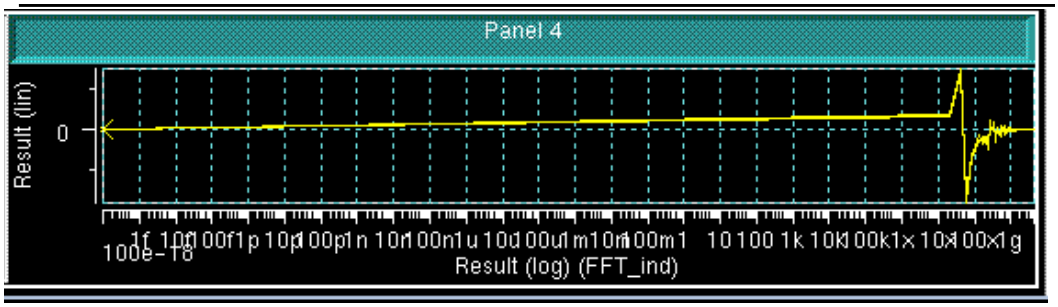
1. Click in the area around the X-axis to display its associated pop-up menu.
2. To change the scale of the axis from Linear to Logarithmic, select **Logarithmic**, then click **Apply** or **OK**, as shown in Figure 11-9.

Figure 11-9 Selecting Logarithmic on the Scaling dialog



The results display scale changes from linear to logarithmic and the view of the waveform in the panel changes.

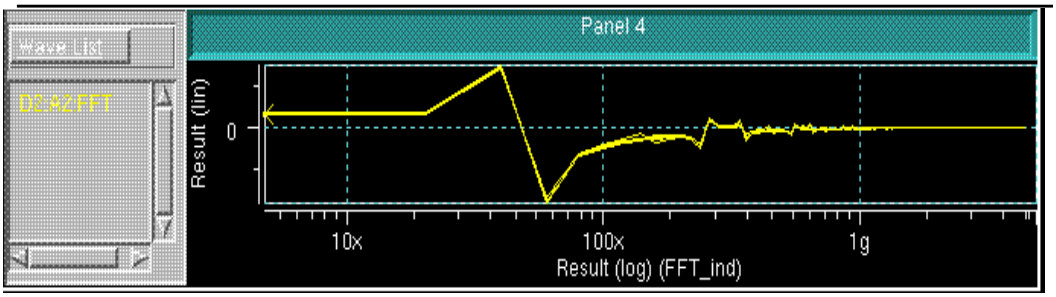
Figure 11-10 Frequency response waveform displayed using logarithmic scale



3. Zoom into the high frequency area of the plot by selecting **Zoom** → **Zoom In X** from the context-sensitive menu in the panel. Select the range in which to zoom.

   The zoomed display is shown in Figure 11-11.

Figure 11-11 Frequency response waveform after selecting Zoom In X



Transient Analysis Summary

This example demonstrated how to evaluate the results of a transient and FFT Analysis using AvanWaves, which involved

- Selecting specific sweeps from a group of sweeps and use the Sweep Filter.

- Using the Measure option to measure the delay between waveforms.
- Zooming in on a section of a waveform using the **Zoom In X** option.
- Viewing an element's FFT frequency response by creating expressions.
- Changing the scale of the X-axis.

AC Analysis

The next example demonstrates how AvanWaves is used to create a Bode plot using the AC analysis results obtained from a Star-Hspice simulation. The design *amc1741.sp,* in the *$installdir/awaves/tutorial/ac* directory, is used in this example.

Open the design, *amc1741.sp,* as previously described, by selecting **Design → Open,** and then typing in the design path name:

```
$installdir/demo/awaves/tutorial/ac/amc1741.sp
```

The Results Browser is displayed, listing all of the analysis files associated with this design.

Displaying Waveforms

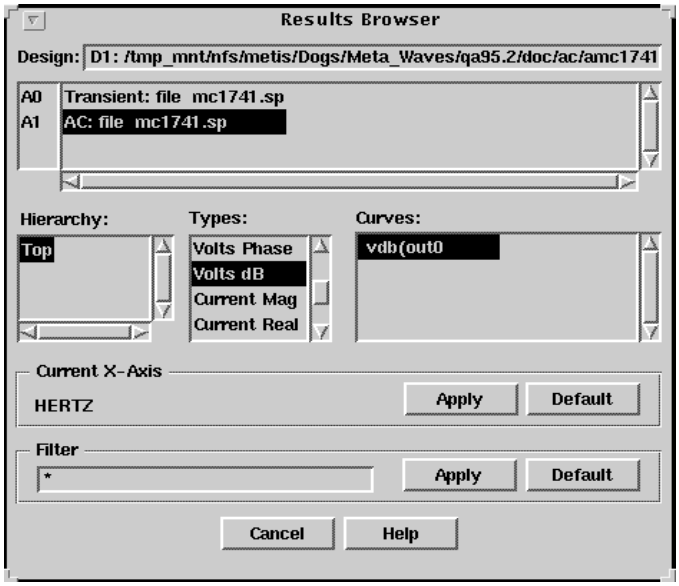
In this section, two waveforms from the same analysis, but having a different type, are displayed.

To display two waveforms in the same panel:

1. In the Results Browser, select the AC analysis, **A1**.
2. In the Types section, select **Volts dB** for the analysis type.

   A list of all the curves associated with that type in the Curves area is displayed.
3. In the Curves section of the Results Browser, select the curve **vdb(out0**, then drag it into the Panel in the Results Display window.

Figure 11-12 Results Browser with vdb(out0 selected



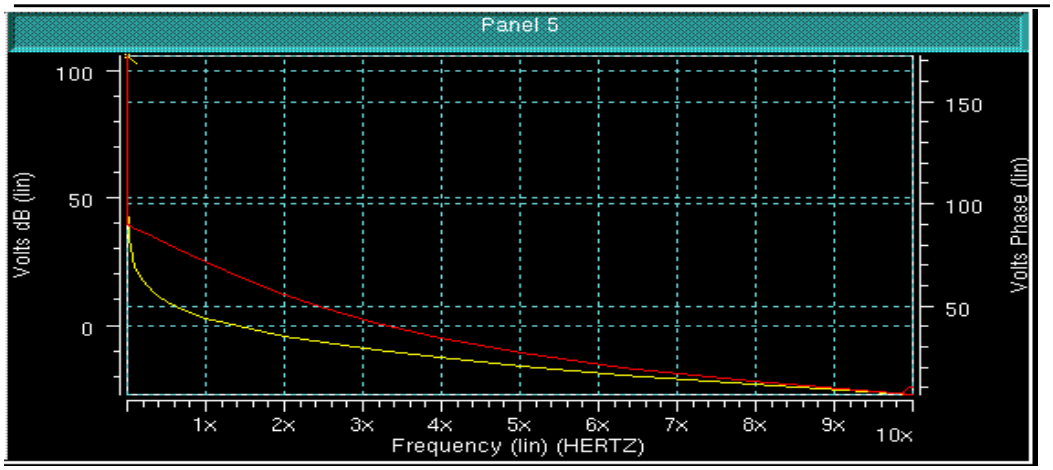
The first waveform is now displayed in the panel. Now select the second waveform from the same analysis, but having a different data type, as follows:

1. In the Types section, select the type **Volts Phase**.

   A list of all the curves associated with that type in the Curves area is displayed.

2. In the Curves section of the Results Browser, select the curve **out0** and drag it into the Panel in the Results Display window.

Figure 11-13 Display of vdb(out0 and out0



Changing the Scale of the Display

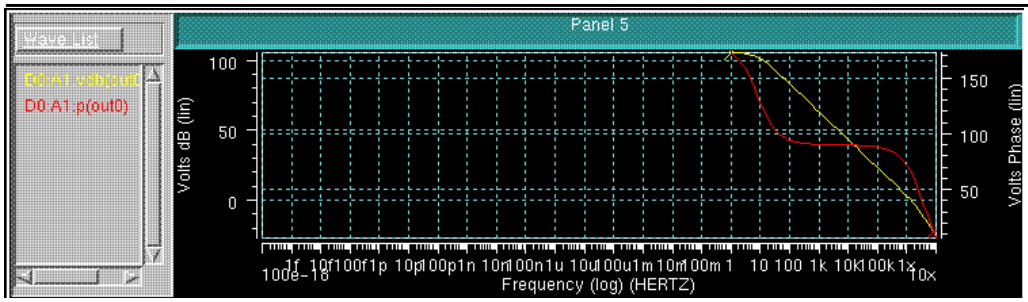
To change the scale of the X-axis:

1. Using the right mouse button, click in the horizontal axis area to display the context-sensitive pop-up menu.
2. Select the option **Scale** from this menu.

   A dialog box is displayed that allows you to change the scale of the axis.
3. Click the Logarithmic button to change the scale from Linear to Logarithmic, then click **OK**.

Figure 11-14 Parameters out0 and vdb(out0) displayed on a

logarithmic scale



Setting the Zoom Factor

To set the zoom factor for viewing a specific section of the waveform:

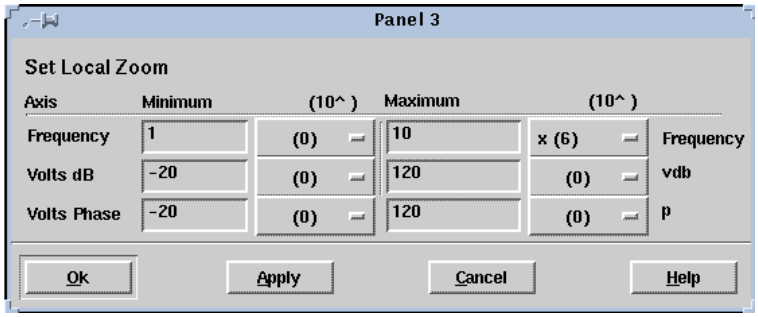
1. Click in the waveform display area of the panel to display the context-sensitive pop-up menu.
2. Select **Set Zoom** from the pop-up menu.

   The Set Local Zoom dialog is displayed, as shown in Figure 11-15.
3. In the Set Local Zoom dialog, set the following values for the variables displayed, by typing them into the text entry area:
   - ❑ For Frequency, set Minimum to 1 and Maximum to 10x.

     The scale factors are displayed in the field next to the text entry area. Click on the scale factors required to select it.

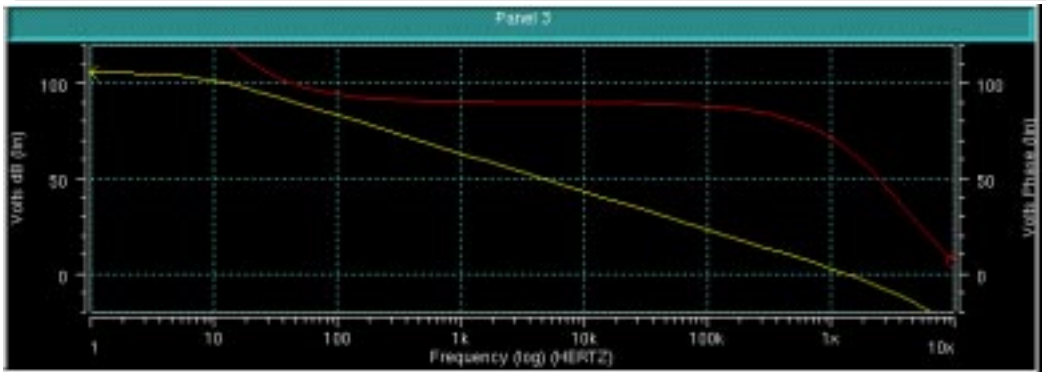
     To change the unit from 0 to x, in the pop-up menu, select **x(6)**.
   - ❑ For Volts Phase, set the Minimum to -20 and the Maximum to 120.
   - ❑ For Volts dB, set the Minimum to -20 and the Maximum to 120.
4. Click **OK** to apply the changes.

Figure 11-15 Set Local Zoom dialog



The view in the panel changes to reflect the zoom factor selected, shown in Figure 11-16. This is the Bode plot that we wanted to display.

Figure 11-16 vdb(out0 and out0 displayed after setting the zoom factor



When using Bode plots you generally want to measure the phase margin, which is the phase at 0 dB gain.

Measuring Unity Gain Frequency and Phase Margin

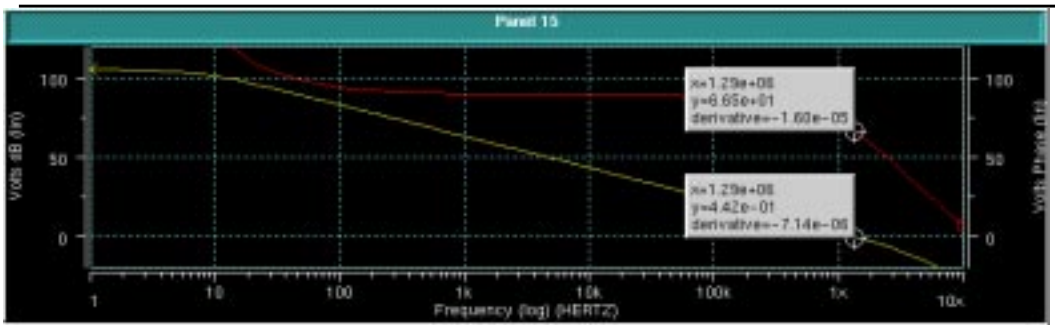
To measure the frequency at 0 dB gain:

1. Click in the Results Display area of the Panel to display the context-sensitive menu, then select **Measure Preference** → **All Values**.
2. From the main menu of the Results Display window, select **Measure** → **Point**.

   This allows you to identify points in the display area.
3. Place the first marker on the **vdB(out0** curve at Volts dB = 0. Note the unity gain frequency (look at the value in the X coordinate box on the Accelerator menu bar).
4. Select **Measure** → **Point** again. This time place a marker on the Volts Phase curve at the same X value (frequency) as the first marker. To ensure that you have the same X coordinate, again check the frequency in the X coordinate box on the Accelerator menu bar.

   The Y value for the second marker, the Phase at 0 dB gain, is the value of the phase margin.

Figure 11-17 Bode Plot displaying the Unity Gain and Phase Margin



Saving the Configuration

To save the configuration, all of the displays and associated parameters, click **Configuration** → **Save** and enter a name, for

example *bode*, for the configuration. The aspects of the present analysis are saved in configuration file *bode.cfg*.

To bring up the same configuration another time, you can open the configuration file *bode.cfg*, after opening the associated design.

AC Analysis Summary

In this example you learned how to create a Bode plot from an AC analysis, which included:

- Changing the scale of the axes.
- Zooming in on a part of the display .
- Using the Point feature and coordinate value boxes to find the phase margin.
- Saving all aspects of the analysis in a configuration.

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12

Accessing Online Help

In AvanWaves you can get online Help on how to

- Use a function in a particular window or dialog box, by clicking the **Help** button
- Use a feature, command, or function available in AvanWaves, either by using the Help-DocSet Browser or by using the Topic arrow keys in each Help page.

To access the AvanWaves online Help system:

- Click the **Help** button in a window or dialog box.

  The associated Help page is displayed.

  or

- Position the cursor inside the window on which you want help and press the **F1** key. This displays the Help page for the currently-selected window or dialog box.

Once you are in the Help system, you can move to other topics using the buttons and menu options available. The Help system has two primary dialog boxes that are used to find a desired topic, the Help page and the Help-DocSet Browser. These two windows are described in the following sections.

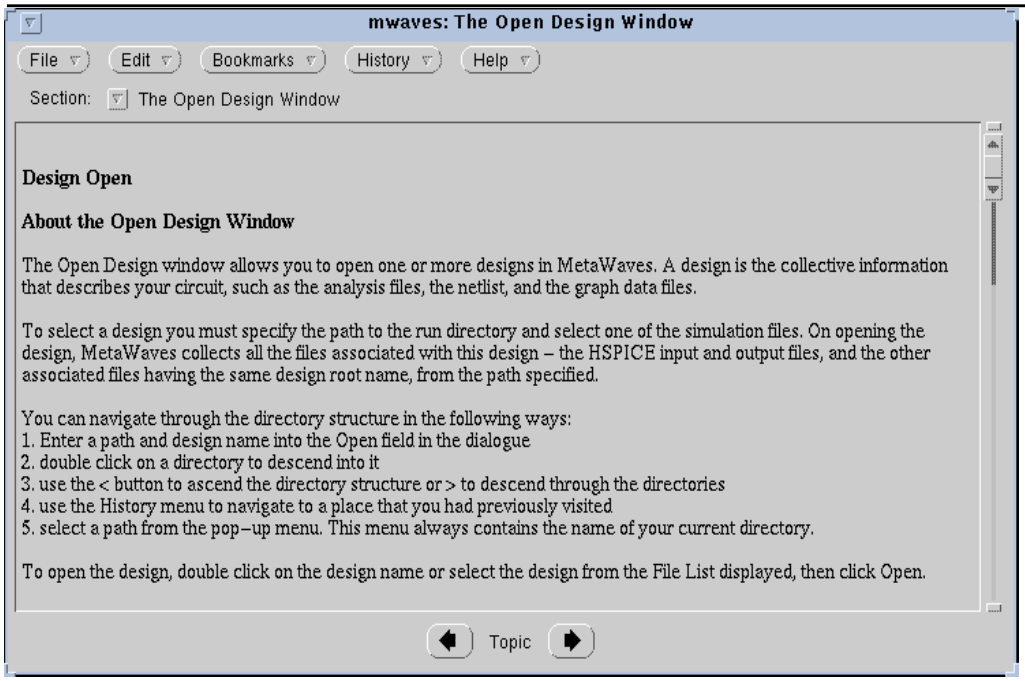
Using the Help Page

A Help page is displayed when you ask for Help on a particular topic. The Help page contains help on the topic requested, such as a topic, feature, function, procedure, or command description, as shown in Figure 12-1.

The following pop-up menu buttons are available on each Help page:

File	Enables you to open and close Help pages as you need them. You can call up the Table of Contents, which is a general index to all the topics available in Help.
Edit	Not implemented for this release.
Bookmarks	Enables you to put markers in a document in areas of specific interest to you, and keeps a list of these markers so that you can return to a particular topic at a later time.
History	Lists the five most recent topics and subtopics that you have viewed during the current Help session. You can use this list to go back to a topic and navigate faster between topics of interest.
Help	Provides information on the Galaxy product that is used to implement the Help system.

Figure 12-1 Help page


mwaves: The Open Design Window
File
Edit
Bookmarks
History
Help
Section:
The Open Design Window
Design Open
About the Open Design Window
The Open Design window allows you to open one or more designs in MetaWaves. A design is the collective information that describes your circuit, such as the analysis files, the netlist, and the graph data files.
To select a design you must specify the path to the run directory and select one of the simulation files. On opening the design, MetaWaves collects all the files associated with this design – the HSPICE input and output files, and the other associated files having the same design root name, from the path specified.
You can navigate through the directory structure in the following ways:
1. Enter a path and design name into the Open field in the dialogue
2. double click on a directory to descend into it
3. use the < button to ascend the directory structure or > to descend through the directories
4. use the History menu to navigate to a place that you had previously visited
5. select a path from the pop–up menu. This menu always contains the name of your current directory.
To open the design, double click on the design name or select the design from the File List displayed, then click Open.
Topic

Using the Section Menu

The Section pop-up menu displays a list of the Help topics associated with the currently selected topic. The list always contains the parent of the topic selected and the selected topic. At the top level, the list contains all entries under the parent topic.

To select a topic from the list, click on the Section menu button, then click on the desired topic in the list. The Help page displays Help for the selected topic.

Using the Topic Selection Arrows

The Topic selection arrows are found at the bottom of each Help page and dialog box. You can step through the Help topics listed on the Help-DocSet Browser using these keys by clicking on the arrow in the direction that you want to move on the Help-DocSet Browser list. The previous or next topic on the Help-DocSet Browser is displayed in the Help page.

Note: The most convenient way to navigate through Help topics is to use the Help-DocSet Browser, since it provides you with a complete list of all the topics and subtopics on which you can get help.

You can access the Help-DocSet Browser through the File menu in the Help page. Select ***File*** *→* ***Table of Contents****, which displays the Help-DocSet Browser. Double-click on a topic in the list to get Help on that topic. See the description of how to use the Help-DocSet Browser below.*

Using Bookmarks

The Bookmark menu allows you to mark a topic to be included in the list of bookmarks. These are points of reference in the Help system to which you can return at any time during the current AvanWaves session. You also can clear bookmarks that have been set.

To insert a Bookmark:

- Select **Bookmarks** → **Mark Here**.
  This adds the currently displayed topic to the Bookmarks List. The list of Bookmarks can be seen appended onto the Bookmarks menu.

To display a topic marked by a Bookmark:

- Select the Bookmarks menu and one of the Bookmarks listed in this menu.
  The contents of the Help page are updated to reflect the selection.

To delete a Bookmark:

1. Select **Bookmarks** → **Edit**. The Bookmark Editor is displayed.

2. Select the bookmark that you want to delete from the list, then select
   Edit → **Clear**.
   This removes the Bookmark from the list.

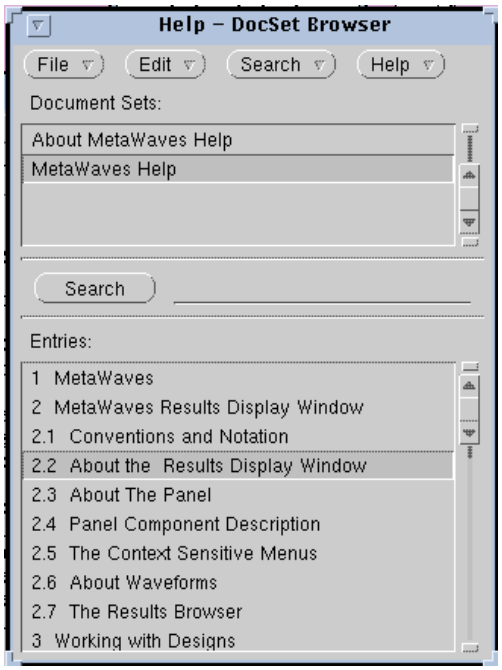
To exit from the online Help system:

- Select **File** → **Close Browser** from the Help page menu.

Using Help-DocSet Browser

When you first open the Help-DocSet Browser, the entry displayed in the current Help page is highlighted in the Entries list (See Figure 12-2). If you open another Help page or select help on another topic, the entry selection in the Help-DocSet Browser is updated to reflect the most current selection. Only one Help-DocSet Browser can be opened at a time.

Figure 12-2 Help-DocSet Browser



Selecting **File** → **Table of Contents** in another Help page updates the current Help-DocSet Browser to reflect the contents of the currently selected Help page.

Using the Entries List to Get Help

You can get help on any topic or subtopic from the Entries list. Use the scroll bar to scroll through the list of available Help topics.

To get help on a new topic or subtopic:

1. Select the entry you want from the Entries list.
2. Double-click on the entry.
   The entry you selected is displayed in the Help page.

Using Search to Get Help

You can search for help on a particular topic by using the Search menu, or by entering keywords directly into the Search field and then clicking the Search button. You can type an entry directly into the Search field and click Search to search for it.

To search based on keywords:

1. Select **Search** → **List Keywords** from the menu to display the Keywords List.
2. Double-click on a keyword in this list to enter it into the search field.

   You can enter multiple search criteria by continuing to double-click on keywords in the Keyword List. The keywords are automatically entered in succession into the Search field.
3. Click **Search** to search for the Entries specified.

   If the search is unsuccessful and does not return any topics, clear the Search field and press **Return** to display the full list of Help topics.

   If the search is successful, the list of relevant topics are displayed in the Entries section of the Help-DocSet Browser. Double-click on an Entry to display the Help for it.

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A

Command Summary

This appendix contains a summary of the commands available in AvanWaves.

Table A-1 Command Summary

Menu	Command	Description
Design Æ Open...		Opens a dialog box listing paths to designs that can be opened and used in your analysis.
	Æ History	Lists the last five designs opened during the current AvanWaves session.
	Æ Special Æ Home	Returns you to your home directory.
	Æ Special Æ Mark	Marks a directory location for the history list.
	Æ Special Æ Unmark	Removes the current directory location from the marked list.
	Æ View Æ by Name	Lists the files by name in alphabetical order.
	Æ View Æ by Date Modified	Lists the files according to the last date they were modified.
	Æ View Æ by Date Created	Lists the files by the date they were created.
	Æ Filter Æ Input	Displays the input files only.

Table A-1 Command Summary (Continued)

Menu	Command	Description
	Æ Filter Æ Listing	Displays the listing files only.
	Æ Filter Æ Raw Output	Displays raw data files only (Star-Hspice graph data files).
	Æ Filter Æ Measures	Displays measure data files only.
	Æ Filter Æ All Files	Displays all the files in the current directory.
	Æ Filter Æ Optionsº	Displays files with a particular input or output suffix.
Design	Æ Closeº	Closes the selected design from the list of designs in the Close Design dialog.
	Æ Currentº	Displays the path to the currently active design (the design that is open in the Results Browser).
	Æ Exit	Exits from the current AvanWaves session, saving the display to a configuration, if the option is selected.
Panels	Æ Add	Adds a new panel to the display area and lists it in the Panel List.
Panels	Æ Hide	Closes the selected panel.
	Æ Delete Panel	Removes the selected panel from the display area and removes the panel name from the Panel List. The Delete command works on a selected Panel and also by selecting the panel name in the Panel List.
	Æ Delete Curves	Removes the currently selected curve from the panel and the name of the curve and the associated sweeps from the Wave List.

Table A-1 Command Summary (Continued)

Menu	Command	Description
	Æ Update	Updates the currently displayed panels with the most recent information from your design files.
	Æ Add Label	Displays a Label dialog box for entering the text for a label to place in a panel.
	Æ Delete Label	Removes the selected label from the panel.
	Æ Stacked/Overlay Mode	Toggles between stacked waveform mode and overlaid waveform model in the selected panel(s).
Window	Æ Full	Displays the full view of the waveforms displayed in a panel.
	Æ Zoom In X	Zooms into a selected area of the panel in relation to the X-axis.
	Æ Zoom Out X	Zooms out from a selected area of the panel in relation to the X-axis.
	Æ Zoom In Y	Zooms into a selected area of the panel in relation to the Y-axis.
	Æ Zoom Out Y	Zooms out from a selected area of the panel in relation to the Y-axis.
	Æ Zoom In X/Y	Zooms in any direction into a selected area of the panel.
	Æ Zoom Out X/Y	Zooms in any direction out of a selected area of the panel.
	Æ Last Zoom	Displays the previous zoom selection in the panel.
	Æ Set Zoom	Allows you to set scale X and Y values to define the limits of the display window. For the field following the numeric values select units from a range of *milli* to *tera*.

Table A-1 Command Summary (Continued)

Menu	Command	Description
	Æ Pan X	Moves the waveform view in relation to the X-axis by the amount specified.
	Æ Pan Y	Moves the waveform view in relation to the Y-axis by the amount specified.
	Æ Pan X/Y	Moves the waveform view in any direction by the amount specified.
Measure	Æ Point	Identifies a selected point on a waveform.
Measure	Æ PointToPoint	Measures the distances between two points selected on a waveform (“deltaX” and “deltaY”) and the slope between the two points . The measurements label appears adjacent to the final point.
	Æ Delete Measure	Deletes the selected measure from the panel display.
	Æ Delete All Measure	Removes all measure values from the panel display.
Measure Æ Measure Label Options	Title	Allows a user title to be entered into a field of this window. This title subsequently appears in each measurement label.
	X1	Causes the X-coordinate of the initial point to be displayed for a PointToPoint measurement.
	Y1	Causes the Y-coordinate of the initial point to be displayed for a PointToPoint measurement.
	Current X	Displays the X-value for a Point measurement. This value is shown for the last point of a PointToPoint measurement.

Table A-1 Command Summary (Continued)

Menu	Command	Description
	Current Y	Displays the Y-value for a Point measurement. This value is shown for the last point of a PointToPoint measurement.
	Delta X	Displays the X-increment for a PointToPoint measurement.
	Delta Y	Displays the Y-increment for a PointToPoint measurement.
	Slope	Displays slope = delta Y/ delta X for a PointToPoint measurement.
	Derivative	Displays dy/dx for a single point or for the last point of a PointToPoint measurement.
	Hide	Causes subsequent labels to be hidden. They can be displayed later by resetting Hide.
	Orientation	Determines where the label window appears with respect to the measure point. There are four options: NW, NE, SW, and SE.
Measure Æ Measure Preferences	Set Snap Æ Data Point	Allows measurements only between data points on a waveform.
	Set Snap Æ All Values	Allows measurements on all parts of the waveform.
	Set Lock Æ All Angle	Measurement operations can be performed at any angle.
	Set Lock Æ Lock Vertical At first point	Measurement operations can only be performed in the X direction.

Table A-1 Command Summary (Continued)

Menu	Command	Description
	Set Lock Æ Lock Horizontal At first point	Measurement operations can only be performed in the Y direction.
	Set Lock Æ Lock Vertical At X Value	Measurement operations can only be performed in the X value specified by the first measure point.
	Set Lock Æ Lock Horizontal At Y Value	Measurement operations can only be performed in the Y value specified by the first measure point.
	Æ Precision	Sets the precision of the value obtained from measure operations.
	Æ Anchor Cursor	Drops a pair of anchored cursors.
	Æ Remove Cursor	Removes the selected pair of anchored cursors.
	Æ Anchor cursor	Displays an anchored cursor showing x and y values.
	Æ Remove Anchor	Removes the existing anchor.
Configuration	Æ Openº	Opens a configuration that was previously saved.
	Æ Saveº	Saves the current panel and analysis environment as a configuration.
	Æ Deleteº	Removes a selected configuration from the list of saved configurations.
Tools	Æ Results Browserº	Displays the Results Browser containing the currently active design analysis files. This is the same as clicking on the Results Browser icon on the accelerator menu.

Table A-1 Command Summary (Continued)

Menu	Command	Description
	Æ Expressions	Displays the Expression Builder, which contains the functions and operators to be used in creating expressions and macros in AvanWaves. This is the same as clicking on the Expression Builder icon on the accelerator menu.
Tools Æ Expressions Æ Macro	Æ Add Macroº	Displays a dialog for creating macros to use in expressions.
	Æ Edit Macroº	Displays a dialog allowing you to edit the macro.
	Æ Load Macroº	Displays a dialog for loading a previously saved Macro.
Tools Æ Expressions Æ Macro	Æ Save Macroº	Saves a Macro for future use.
Æ Load Macroº Æ Save Macroº	Æ History	Lists the last five designs opened during the current AvanWaves session that can be selected and opened.
	Æ Special Æ Home	Returns you to your home directory.
	Æ Special Æ Mark	Marks a directory location for the History list.
	Æ Special Æ Unmark	Removes the current directory location from the marked list.
	Æ View Æ by Name	Lists the files by name in alphabetical order.
	Æ View Æ by Date Modified	Lists files according to the last date they were modified.
	Æ View Æ by Date Created	Lists files by the date they were created.
	Æ Filter Æ Macro Definitions	Lists files that contain Macro definitions.
	Æ Filter Æ All Files	Lists all files in the design.

Table A-1 Command Summary (Continued)

Menu	Command	Description
Tools Æ Print Æ Print button	Æ History	Lists the last five designs opened during the current AvanWaves session that can be selected and opened.
	Æ Special Æ Home	Returns you to your home directory.
	Æ Special Æ Mark	Marks a directory location for the History list.
	Æ View Æ by Name	Lists the files by name in alphabetical order.
	Æ View Æ by Date Modified	Lists files according to the last date they were modified.
	Æ View Æ by Date Created	Lists files by the date they were created.
	Æ Filter Æ PostScript	Lists files that are in PostScript format.
	Æ Filter Æ Encapsulated PostScript	Lists all files that are in encapsulated PostScript format.
	Æ Filter Æ All Files	List all files.
Tools Æ Preferencesº		Opens the Select Preferences dialog for setting personal application preferences.
	Æ File Æ Close Window	Closes the Select Preferences window.
	Æ Edit Æ Selected	Displays the Set Analysis Preferences dialog for setting waveform and symbol preferences.
	Æ Edit Æ Application Æ About	Displays the AvanWaves “About” box.
	Æ Edit Æ Application Æ General	Displays the Set General Preferences dialog for setting the foreground and background color and the font used by the application.
	Æ Edit Æ Analysis Æ Curves	Displays Set Analysis Preferences dialog that controls waveform display attributes.

Table A-1 Command Summary (Continued)

Menu	Command	Description
Help		Opens the AvanWaves on-line Help system.
Set Zoom		Displays the Set Zoom dialog for setting the zoom factor for zooming in and out of selected areas in a panel.
Set Pan		Displays the Set Pan dialog for setting values for panning in a panel.
Monotonic/ Continuous Plot		Selects a monotonic or continuous waveform in the panel.
Sweep Filter		Displays a dialog box containing the sweeps associated with the waveforms in the selected panel. Sweeps can be selected or deselected for viewing by clicking on them.
Scale	Æ Linear	Selects a linear scale.
	Æ Logarithmic	Selects a logarithmic scale.

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B

Operators and Functions

This appendix lists the operators and functions currently available in AvanWaves.

Operators

The following operators are available for use in expressions in AvanWaves.

Arithmetic Operators

The following are arithmetic operators:

Operator	Function Description
+	Addition
-	Subtraction
*	Multiplication
/	Division

Comparison Operators

The following operators perform comparisons and return values of 0 or 1:

Operator	Function Description
>	Greater than
<	Less than

<=	Greater than or equal to
>=	Less than or equal to
!=	Not equal to
==	Equal

Boolean Operators

The following operators evaluate Boolean expressions and return values of 0 or 1:

Operator	Function Description
&&	Performs the AND operation. Returns 1 if both values are nonzero, and returns 0 otherwise.
||	Performs the OR operation. Returns 1 if either value is nonzero, and returns 0 otherwise.
!	Performs the NOT operation. Returns 1 if its argument is 0, and returns 0 otherwise.

Conditional Operator

The following conditional operator is available:

Operator	Function Description
<*expr1*> ? <*expr2*> : <*expr3*>	<*expr1*>, <*expr2*>, and <*expr3*> are expressions. If the result of <*expr1*> is nonzero, then the result of <*expr2*> is returned, otherwise the result of <*expr3*> is returned.

Predefined Functions

The functions shown in Table B-1 are available for use in expressions in AvanWaves.

Table B-1 List of Predefined Functions

Function	Description
abs(x)	Returns the absolute value of x, |x|.
atan(x)	Returns the arctangent of x (radians).
atan2(y,x)	Returns the arctangent of y/x between -pi and pi..
cos(x)	Returns the cosine of x (radians).
cosh(x)	Returns the hyperbolic cosine of x (radians).
decibel(x)	Returns the base 10 logarithm of the absolute value of x, multiplied by 20, with the sign of x: (sign of x)20log10(|x|).
derivative (curve)	Returns the derivative of the curve.
exp(x)	Returns e raised to the power x, $e^{x.}$
fftImag(curve, start, stop, numpoints, window, alpha)	Returns the imaginary components of a Fast Fourier Transform. Start and stop must be specified as real decimal numbers, for example: 0.0000000.
fftMag(curve, start, stop, numpoints, window, alpha)	Returns the magnitude of a Fast Fourier Transform: fftMag(curve, start, stop, window, alpha) = mag((fftReal(curve, start, stop,window, alpha), fftImag(curve, start, stop, window, alpha)) start and stop must be specified as real decimal numbers.
fftPhase(curve, start, stop, numpoints, window, alpha)	Returns the phase of a Fast Fourier Transform: fftPhase(curve, start, stop,window, alpha) = phase((fftReal(curve, start, stop,window, alpha), fftImag(curve, start, stop, window, alpha)) start and stop must be specified as real decimal numbers.
fftReal(curve, start, stop, numpoints, window, alpha)	Returns the real components of a Fast Fourier Transform Start and stop must be specified as real decimal numbers.

Table B-1 List of Predefined Functions (Continued)

Function	Description
imag(mag,ph)	Converts polar to rectangular form: imag(mag,ph) = mag * sin(ph).
integer(x)	Returns the integer portion of x (truncates the decimal portion).
integral(curve)	Returns the integral of the curve.
log(x)	Returns the natural logarithm of the absolute value of x, with the sign of x: (sign of x)log(|x|).
log10(x)	Returns the base 10 logarithm of the absolute value of x, with the sign of x: (sign of x)$\log_{10}$(|x|.
mag(y,x)	Converts from rectangular to polar form: sqrt(y*y+x*x).
max(x,y)	Returns the numeric maximum of x and y.
min(x,y)	Returns the numeric minimum of x and y.
phase(y,x)	Converts from rectangular to polar form: returns the arctangent of y/x between -180 and 180 (degrees).
pow(x,y)	Returns x to the power y.
real(mag,ph)	Converts polar to rectangular form: real(mag,ph) = mag * cos(ph).
sin(x)	Returns the sine of x (radians).
sinh(x)	Returns the hyperbolic sine of x (radians).
sqrt(x)	Returns the square root of the absolute value of x: sqrt(-x) = -sqrt(|x|).
tan(x)	Returns the tangent of x (radians).

FFT Parameter Description

Star-Hspice FFT simulation has enhanced accuracy because Star-Hspice FFTs use double precision floating point numbers compared with the single precision floating point of the Graph data files in normal simulation.

Table B-2 shows the parameters used with the FFT functions available in AvanWaves.

Note: The AvanWaves equivalent to the Star-Hspice .FFT simulation is the fftMag function.

Table B-2 .FFT Statement Parameters

Parameter	Default	Description
output_var	—	Can be any valid output variable, such as voltage, current, or power
START	See Description	Specifies the beginning of the output variable waveform to be analyzed. Defaults to the START value in the .TRAN statement, which defaults to zero seconds. Specify this value as a real, decimal number, for example 0.00000001. Invalid specification examples are: 10n, 10ns, 1.0 e^{-8}.
STOP	See Description	Specifies the end of the output variable waveform to be analyzed. Defaults to the TSTOP value in the .TRAN statement.
NP	1024	Specifies the number of points used in the FFT analysis. NP must be a power of 2. If NP is not a power of 2, Star-Hspice automatically adjusts it to the closest higher number that is a power of 2.

Table B-2 .FFT Statement Parameters

Parameter	Default	Description
WINDOW	RECT	Specifies the window type to be used: "RECT"=simple rectangular truncation window "BART"=Bartlett (triangular) window "HANN"=Hanning window "HAMM"=Hamming window "BLACK"=Blackman window "HARRIS"=Blackman-Harris window "GAUSS"=Gaussian window "KAISER"=Kaiser-Bessel window
ALFA	3.0	Specifies the parameter used in GAUSS and KAISER windows to control the highest side-lobe level, bandwidth, and so on. 1.0 <= ALFA <= 20.0

In FFT analysis, windows are frequency weighting functions applied to the time domain data to reduce the spectral leakage associated with finite-duration time signals. Windows are smooth functions that peak in the middle frequencies and decrease to zero at the edges, thus reducing the effects of the discontinuities as a result of periodic extension.

Table B-3 lists the common performance parameters for FFT windows available in Star-Hspice.

Refer to Star-Hspice Application Note 6144, "FFT Spectrum Analysis," for more information about FFT windows and FFT simulations.

Table B-3 Window Weighting Characteristics in FFT Analysis

Window	Equation	Highest Side-Lobe (dB)	Side-Lobe Roll-Off (dB/ octave)	3.0-dB Bandwidth (1.0/T)	Worst Case Process Loss (dB)
Rectangular	$W(n)=1$, $0 \le n < NP^{\dagger}$	-13	-6	0.89	3.92

Table B-3 Window Weighting Characteristics in FFT Analysis

Window	Equation	Highest Side-Lobe (dB)	Side-Lobe Roll-Off (dB/ octave)	3.0-dB Bandwidth (1.0/T)	Worst Case Process Loss (dB)
Bartlett	$W(n)=2n/(NP-1)$, $0 \le n \le (NP/2)-1$ $W(n)=2-2n/(NP-1)$, $NP/2 \le n < NP$	-27	-12	1.28	3.07
Hanning	$W(n)=0.5-0.5[\cos(2\pi n/(NP-1))]$, $0 \le n < NP$	-32	-18	1.44	3.18
Hamming	$W(n)=0.54-0.46[\cos(2\pi n/(NP-1))]$, $0 \le n < NP$	-43	-6	1.30	3.10
Blackman	$W(n)=0.42323-0.49755[\cos(2\pi n/(NP-1))]+0.07922\cos[\cos(4\pi n/(NP-1))]$, $0 \le n < NP$	-58	-18	1.68	3.47
Blackman-Harris	$W(n)=0.35875-0.48829[\cos(2\pi n/(NP-1))]+0.14128[\cos(4\pi n/(NP-1))]-0.01168[\cos(6\pi n/(NP-1))]$, $0 \le n < NP$	-92	-6	1.90	3.85

Table B-3 Window Weighting Characteristics in FFT Analysis

Window	Equation	Highest Side-Lobe (dB)	Side-Lobe Roll-Off (dB/ octave)	3.0-dB Bandwidth (1.0/T)	Worst Case Process Loss (dB)
Gaussian α=2.5 α=3.0 α=3.5	$W(n)=\exp[-0.5\alpha^2(NP/2-1-n)^2/(NP)^2]$, $0 \le n \le (NP/2)-1$ $W(n)=\exp[-0.5\alpha^2(n-NP/2)^2/(NP)^2]$, $NP/2 \le n < NP$	 -42 -55 -69	 -6 -6 -6	 1.33 1.55 1.79	 3.14 3.40 3.73
Kaiser-Bessel α=2.0 α=2.5 α=3.0 α=3.5	$W(n)=I_0(x_2)/I_0(x_1)$ $x_1=\pi\alpha$ $x_2=x_1*\mathrm{sqrt}[1-(2(NP/2-1-n)/NP)^2]$, $0 \le n \le (NP/2)-1$ $x_2=x_1*\mathrm{sqrt}[1-(2(n-NP/2)/NP)^2]$, $NP/2 \le n < NP$ I_0 is the zero-order modified Bessel function	 -46 -57 -69 -82	 -6 -6 -6 -6	 1.43 1.57 1.71 0.89	 3.20 3.38 3.56 3.74

†NP is the number of points used for the FFT analysis.

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C

Terms and Naming Conventions

This appendix provides the AvanWaves terms and naming conventions.

Glossary of AvanWaves Terms

Analysis	The execution of a particular type of simulation — for example, AC, DC, or transient analysis. A number of analysis can be performed on each run.
Continuous Plot	A graph that has points connected in all directions, both positive and negative.
Curves	The output waveforms for variables simulated in Star-Hspice.
Design	The collective information that describes your circuit, such as the analysis files, the netlist, the graph data files, and so on. AvanWaves provides a graphical representation of your circuit design.
Graph	The graphical representation of the results derived from a simulation run,

	also known as a waveform or curve. A graph is displayed inside a panel.
Graph data file	The Star-Hspice output data files from either sweeps or measures.
Star-Hspice	Avan-Software's circuit simulator
Monotonic Plot	A graph that has points connected in the X direction only
Panel	Contains all of the information about an analysis in graphical form. A panel has a title, a wave display area, an X-axis and Y-axis, and a Wave List. The number of panels displayed is limited by the window size.
Results Browser	The dialog box containing a list of all simulation results available for the current design
Run files	Files resulting from an Star-Hspice simulation run.
Sweep	A set of simulation output data with parametric variation. In Star-Hspice, known as an "outer loop sweep".
Sweep Filter	The filter is used to limit the number of data points displayed in the curves area to those that you specifically require.
Wave Display area	The area of a panel in which waveforms are displayed.
Waveform	Plotted data from a simulation.
Waveform Display	The graphical display area inside a panel.
Wave List	A list of the currently displayed waveforms.

Naming Conventions

Analysis	Analyses are represented by Analysis numbers, A0 through A*n*. Each

	analysis has a unique number that acts as an identifier for that analysis.
Configuration	Configurations have names assigned by users. They are saved in files of the form <*config_name*>.*cfg*.
Design	Designs are represented by a design number, D0 through D*n*. Each design has a unique number that acts as an identifier for that design.
Expression	Expressions consist of a user-assigned name and definition. The definition is made up of functions, macros and their arguments, and operators.
Macro	Macros have names assigned by users. They are saved in files of the form <*macro_name*>.*mac*. Macro parameters must be defined when the macro is created.
Panel	All panels have default names such as Panel1, Panel2, and so on. The number indicates the order in which the panels were opened. You can change panel names.
Sweep	Sweeps are represented by sweep numbers S0 through S*n*. Each sweep has a unique number that acts as an identifier for that sweep.
Waveforms	Waveform names can be no longer than sixteen characters in length. This covers the Star-Hspice limit for relative waveform names.

Avant!

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